. . . THE . . .

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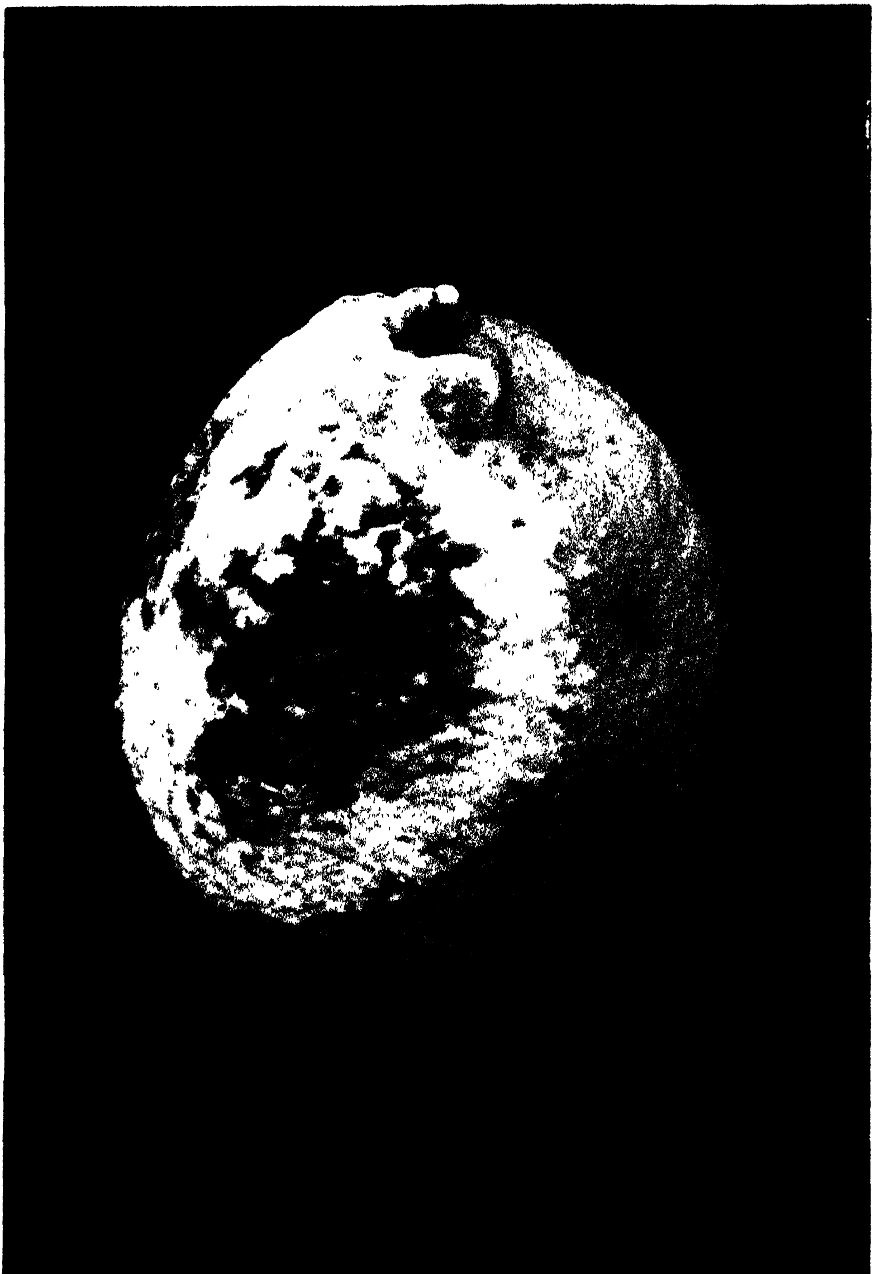

The Citrus Fruit Rot.

(*Penicillium digitatum* (*Fr.*), Sacc.)

On the Rough Lemon; 8 days after inoculation.

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The Measurement of Water in Streams and Furrows.

BY F. A. HURLEY, A.M.Inst.C.E., F.C.H.,
Chief Engineer, Irrigation Department.

LITTLE, if any, attention has hitherto been paid in this country to the economical use of water in irrigating crops. Nevertheless the proper use of water on land is the most important element of any irrigation scheme (large or small), not only for engineering purposes, but in the interests of the farmer. For every crop there is a certain allowance of water, which is sufficient to bring it to maturity; and if it receives water in excess of that amount, the result is to reduce the yield and thus to injure the crop.

Exhaustive experiments on this subject have been conducted in America, and it has there been proved that the over-watering of a crop may have as deleterious an effect on the yield as a drought.

It is quite impossible at present to lay down any hard and fast rule for allowances to crops, which must of necessity vary with the character of the soil, the district (high, middle, or low veld), and the rainfall.

But, although great exactitude is not generally possible in this respect, every farmer can, with care and the aid of a few simple rules, determine for himself the proper amount of water that should be given to any one crop and the proper method of applying it.

The light and frequent waterings often given to crops is, in general a most uneconomical method of using water. Such a method merely wets the surface of the ground, without penetrating to the subsoil, the water is easily and quickly evaporated, and there is a tendency for the roots of crops so irrigated to remain near the surface of the ground, where they are peculiarly liable to injury. It is generally much better to give crops heavy waterings at long intervals rather than light waterings at frequent intervals, since the water can then penetrate to the subsoil, which can be kept moist by cultivation.

As a general rule, no watering less than what is known as a 3-inch watering is economical. By a 3-inch watering is meant that an amount of water is applied to the land which, if it were not absorbed, would be sufficient to cover the area watered to a depth of three inches. A 3-inch

watering on, say, an acre of land, thus represents an amount of water used of

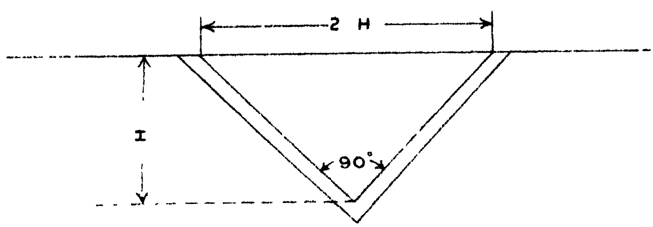
43,560 square feet (1 acre) × ¼ foot (3 inches) = 10,890 cubic feet.

The economical use of water is of advantage in two ways. In the first place, the application of sufficient, and not too much, water to a crop increases the yield; and in the second place, careful use permits a larger area to be irrigated than could otherwise be dealt with.

The first essential for systematic and careful use of water is that the farmer should be able to measure the quantity of water which he is using. The determination of the approximate discharge of furrows and streams can be made by the aid of a few simple rules, and I will confine myself in this article to giving a few rules which can be applied easily by any farmer. It may be as well, at this stage, however, to state that the rules given below must be *strictly* adhered to if good measurements are to be obtained. Some of them, no doubt, appear fanciful and unduly refined, but this is not so—they are all essential.

The most accurate method of gauging the discharge of a small furrow is by means of a triangular notch. (See Plate 1.)

Such a notch can be cut from a well-seasoned board, and the notch should be a true right angle with its apex down. The sides of the notch should be chamfered off at an angle of 45 degrees, and when erected the sharp edge should be upstream and the chamfer downstream, as shown in the sketch.



All gauging notches should work with a free fall, that is to say, that for any quantity of water running over it, the apex of the notch should be *at least* nine inches above the water surface in the furrow below the notch. If the water surface in the furrow below the notch rises above this level, the gaugings (as given in the table below) will not be accurate. The water above the notch should be headed up so that the velocity of the water approaching the notch is small, as, if this velocity is considerable, corrections must be made in the figures of discharge, as calculated by the ordinary notch formula.

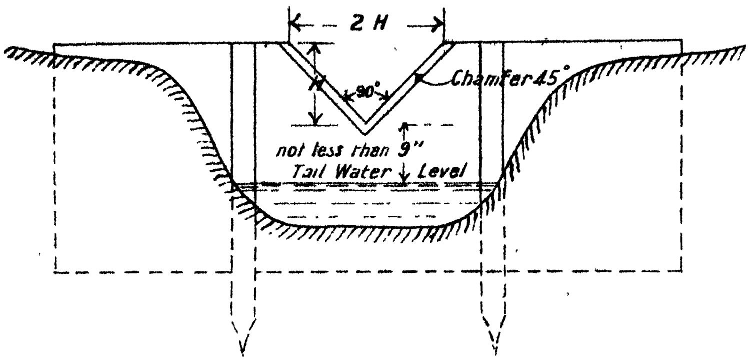
The notch should be fixed in a straight reach of the furrow to be gauged, which should be free from all obstructions. It should be fixed at right angles to the flow of the water and a line drawn through, the apex bisecting the right angle should be vertical.

The depth of water flowing over the notch should be read on a small gauge, divided to read to hundredths of a foot, fixed about three feet upstream of the notch, the zero of the gauge being *exactly* level with the apex of the notch. The discharge of such a notch, working from a still pond above it, is given in the following table.

SKETCH PLAN OF

NOTCH GAUGE.

Down-Stream Elevation



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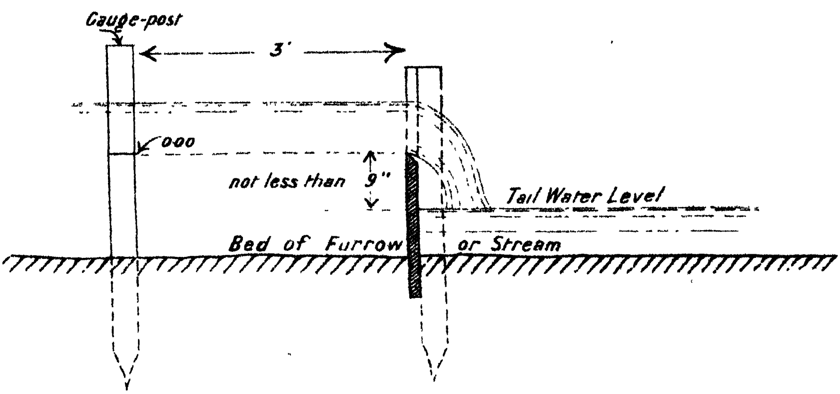


Perspective View.

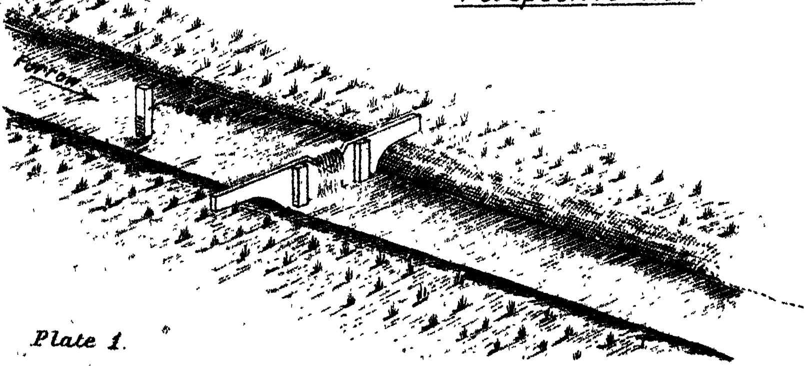


Plate 1.

SKETCH PLAN OF
CIPPOLETTI WEIR

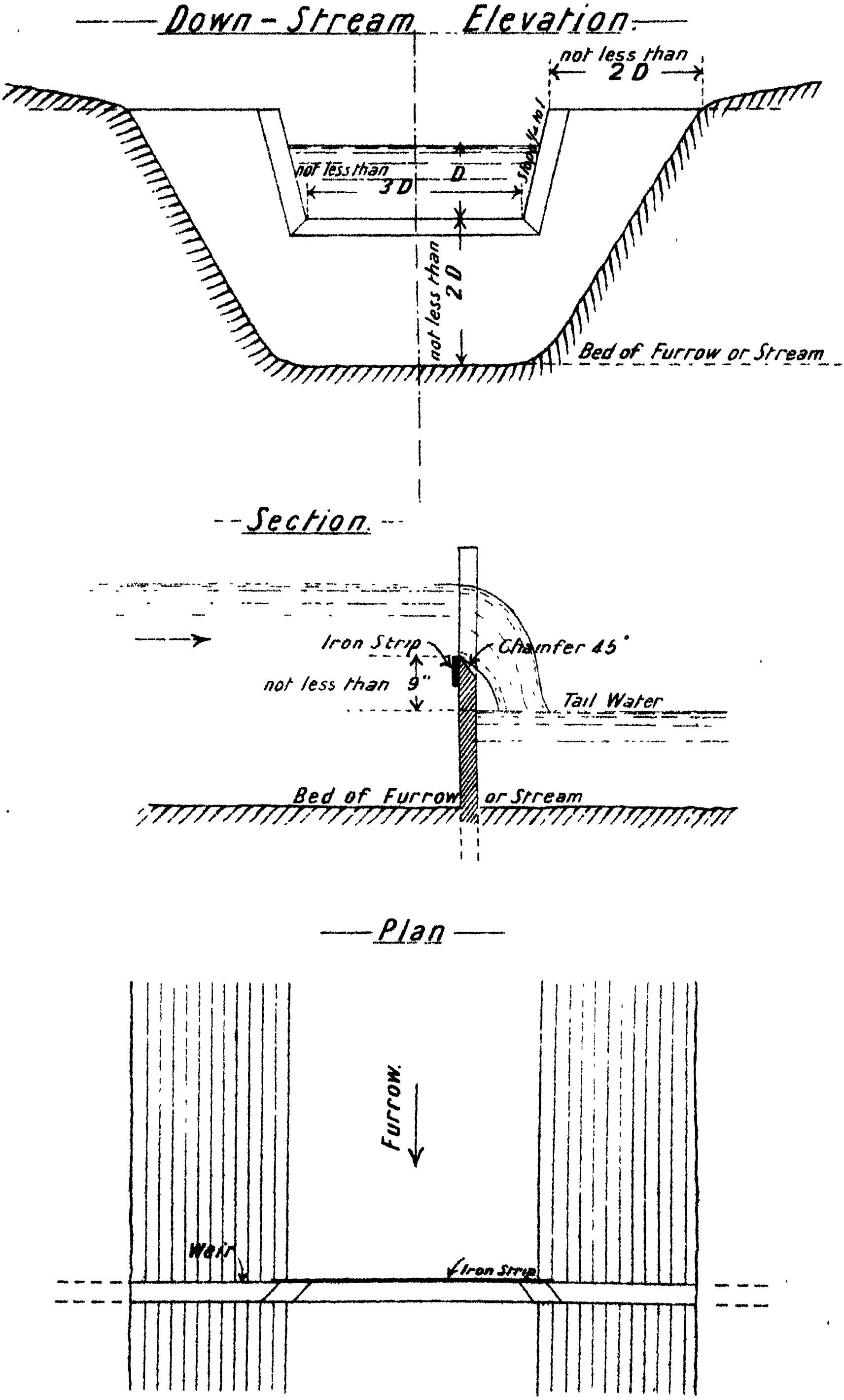


Plate 2.

TABLE OF DISCHARGES.

Table I.

Depth of Water above lowest part of V notch.	Cubic feet per second.	Cubic feet per day	Depth of Water above lowest part of V notch.	Cubic feet per second	Cubic feet per day.
0·1	0·01	864	0·66	0·90	77,760
0·2	0·04	3,456	0·67	0·93	80,352
0·25	0·08	6,912	0·68	0·97	83,808
0·26	0·09	7.776	0·69	1·01	87,264
0·27	0·10	8,640	0·70	1·04	89,856
0·28	0·11	9.504	0·71	1·07	92,448
0·29	0·12	10,368	0·72	1·11	95,904
0·30	0·13	11.232	0·73	1·15	99,360
0·31	0·14	12.096	0·74	1·19	102,816
0·32	0·15	12,960	0·75	1·23	106,272
0·33	0·16	13.824	0·76	1·27	109,728
0·34	0·17	14,688	0·77	1·31	113.184
0·35	0·18	15,552	0·78	1·35	116,640
0·36	0·20	17 280	0·79	1·40	120,960
0·37	0·21	18,144	0·80	1·45	125 280
0·38	0·23	19,872	0·81	1·49	128,736
0·39	0·24	20,736	0·82	1·54	133,056
0·40	0·26	22.464	0·83	1·59	137,376
0·41	0·27	23,328	0·84	1·64	141 696
0·42	0·29	25,056	0·85	1·69	146,016
0·43	0·31	26.784	0·86	1·74	150,336
0·44	0·33	28 512	0·87	1·79	154,656
0·45	0·35	30,240	0·88	1·84	158 976
0·46	0·37	31,968	0·89	1·89	163.296
0·47	0·39	33,696	0·90	1·95	168 480
0·48	0·41	35,424	0·91	2·00	172 800
0·49	0·43	37 152	0·92	2·05	177,120
0·50	0·45	38 880	0·93	2·11	182.304
0·51	0·47	40,608	0·94	2·17	187.488
0·52	0·50	43,200	0·95	2·23	192.672
0·53	0·52	44,928	0·96	2·29	197,856
0·54	0·55	47,520	0·97	2·35	203,040
0·55	0·57	49,248	0·98	2·41	208,224
0·56	0·60	51,840	0·99	2·47	213.408
0·57	0·62	53 568	1·00	2·54	219 456
0·58	0·65	56 160	1·01	2·60	224 640
0·59	0·68	58 752	1·02	2·66	229,824
0·60	0·71	61.344	1·03	2·73	235 872
0·61	0·74	63,936	1·04	2·80	241 920
0·62	0·77	66 528	1·05	2·87	247 968
0·63	0·80	69,120	1·06	2·93	253.152
0·64	0·83	71,712	1·07	3·00	259.200
0·65	0·87	75.168			

For measuring, with accuracy, a discharge exceeding about two cubic feet per second, a trapezoidal notch of the form shown in the sketch should be used.

This is called a Cippoletti Weir. (See Plate 2.) In using this weir the following conditions should be complied with :--

(1) The channel leading to the weir should be straight and of fairly constant cross section. Its axis should pass through the middle of the weir, and the weir should be at right angles to it.

(2) The edges of the notch should be cut away downstream at an angle of about 45 degrees.

(3) The distance of the sill of the weir from the bottom of the furrow or stream must not be less than twice the greatest depth of water

on the weir, and the distance from the sill to the water surface on the downstream side must not be less than nine inches.

(4) The distance of the sides of the notch from the sides of the channel must be not less than twice the greatest depth of water over the weir.

(5) The length of the weir should be at least three times the greatest depth of water flowing over it.

(6) The velocity of approach must be small, not exceeding six inches per second, and the cross sectional area of the channel immediately upstream of the weir should be at least *seven* times that of the notch.

(7) The depth of water flowing over the notch should be read on a gauge, erected truly vertical, three feet upstream of the notch, and graduated to read to one-hundredths of a foot. The zero of the gauge *must* be at the exact level of the sill of the notch.

For very small discharges, this type of notch will not give accurate results, and in such cases the triangular notch should be used.

Table II (taken from Wilson's "Irrigation Engineering") shows the discharge over such weirs of various lengths and for different depths, *when discharging from a still pond*, velocity of approach being neglected.

Table II.

DISCHARGE OVER CIPPOLETTI'S TRAPEZOIDAL WEIR OF VARIOUS LENGTHS AND DEPTHS.

Depth of Water on Crest		Discharge in Cubic Feet per Second over Weir.						
In ins.	In feet.	l = 1 ft.	l = 1·5 ft.	l = 2 ft.	l = 3 ft.	l = 4 ft.	l = 5 ft.	l = 7 ft.
·3	·02	·013	·020	·026	·040	·053	·067	...
·6	·05	·036	·056	·075	·113	·150	·188	...
·9	·07	·069	·103	·138	·207	·276	·345	...
1·2	·1	·106	·159	·212	·319	·425	·531	...
1·5	·12	·148	·223	·297	·446	·595	·744	...
1·8	·15	·195	·293	·391	·586	·782	·978	
2·1	·17	·246	·369	·492	·739	·985	1·232	...
2·4	·2	·301	·451	·602	·902	1·203	1·504	...
2·7	·22	·359	·538	·718	1·077	1·436	1·796	...
3·0	·25	·420	·631	·841	1·262	1·683	2·104	...
3·3	·27	·485	·728	·970	1·456	1·941	2·427	...
3·6	·3	·553	·829	1·106	1·659	2·212	2·765	..
3·9	·32	·623	·935	1·247	1·871	2·495	3·119	...
4·2	·35	·697	1·045	1·394	2·091	2·789	3·486	...
4·5	·37	·773	1·159	1·546	2·319	3·090	3·864	...
4·8	·4	...	1·277	1·703	2·555	3·407	4·258	...
5·1	·42	...	1·399	1·865	2·798	3·731	4·664	...
5·4	·45	...	1·524	2·032	3·049	4·065	5·082	...
5·7	·47	...	1·653	2·204	3·306	4·408	5·511	...
6·0	·5	...	1·785	2·380	3·570	4·761	5·951	...
6·3	·52	...	1·921	2·561	3·842	5·122	6·403	...
6·6	·55	...	2·059	2·746	4·119	5·493	6·866	...
6·9	·57	...	2·201	2·935	4·403	5·871	7·339	...
7·2	·6	...	2·347	3·129	4·693	6·258	7·823	...
7·5	·62	...	2·495	3·327	4·911	6·654	8·318	...
7·8	·65	...	2·646	3·528	5·292	7·056	8·820	...
8·1	·67	...	2·800	3·734	5·601	7·468	9·335	...
8·4	·7	...	...	3·943	5·915	7·887	9·859	13·803
8·7	·72	...	...	4·156	6·234	8·293	10·391	14·547
9·0	·75	...	...	4·373	6·559	8·746	10·933	15·306

Discharge over Cippoletti's Trapezoidal Weir—(*continued*).

Depth of Water on Crest.		Discharge in Cubic Feet per Second over Weir.						
In ins.	In feet	l=1 ft.	l=1·5 ft.	l=2 ft.	l=3 ft.	l=4 ft.	l=5 ft.	l=7 ft.
9·3	·77	...	...	4·591	6·891	9·188	11·485	16·079
9·6	·8	...	...	4·817	7·226	9·635	12·014	16·861
9·9	·82	...	...	5·045	7·567	10·090	12·613	17·658
10·2	·85	...	...	...	7·915	10·553	13·192	18·469
10·5	·87	...	...	...	8·266	11·022	13·778	19·289
10·8	·9	...	...	...	8·623	11·497	14·372	20·121
11·1	·92	...	...	...	8·985	11·980	14·971	20·964
11·4	·95	...	...	...	9·351	12·468	15·586	21·820
11·7	·97	...	...	...	9·723	12·964	16·205	22·687
12·0	1·0	...	...	...	10·100	13·566	16·833	23·566
12·3	1·02	...	...	...	10·480	13·974	17·467	24·455
12·6	1·05	...	...	...	10·866	14·188	18·111	25·355
12·9	1·07	...	...	...	11·257	15·010	18·762	26·267
13·2	1·1	...	...	...	11·652	15·536	19·420	27·188
13·5	1·12	...	...	...	12·051	16·068	20·085	28·119
13·8	1·15	...	...	...	12·455	16·607	20·758	29·062
14·1	1·17	...	...	...	12·864	17·152	21·140	30·016
14·4	1·2	...	...	...	13·276	17·701	22·127	30·978
14·7	1·22	...	...	...	13·693	18·258	22·822	31·951
15·0	1·25	...	...	...	14·114	18·819	23·524	32·934
15·3	1·27	...	...	...	14·541	19·388	24·234	33·928
15·6	1·3	...	...	...	...	19·960	24·950	34·930
15·9	1·32	...	...	...	...	20·539	25·674	35·943
16·2	1·35	...	...	...	...	21·123	26·404	36·966
16·4	1·37	...	...	...	...	21·712	26·140	37·996
16·8	1·4	...	...	...	...	22·307	27·884	39·038
17·1	1·42	...	...	...	...	22·908	28·635	40·089
17·4	1·45	...	...	...	...	23·512	29·391	41·147
17·7	1·47	...	...	...	...	24·124	30·155	42·217
18·0	1·5	...	...	...	...	24·739	30·924	43·294
18·3	1·52	...	...	...	...	25·360	31·700	44·380
18·6	1·55	...	...	...	...	25·986	32·483	45·476
18·9	1·57	...	...	...	...	26·618	33·272	46·581
19·2	1·6	...	...	...	...	...	34·068	47·695
19·5	1·62	...	...	...	...	...	34·870	48·818
19·8	1·65	...	...	...	...	...	35·678	49·919
20·1	1·67	...	...	...	...	...	36·491	51·087
20·4	1·7	...	...	...	...	...	37·311	52·235
20·7	1·72	...	...	...	...	...	38·137	53·392
21·0	1·75	...	...	...	...	...	38·969	54·556
21·3	1·77	...	...	...	...	...	39·807	55·730
21·6	1·8	...	...	...	...	...	40·651	56·912
21·9	1·82	...	...	...	...	...	41·500	58·101
22·2	1·85	...	...	...	...	...	42·357	59·300
22·5	1·87	...	...	...	...	...	43·217	60·503
22·8	1·9	...	...	...	...	...	...	61·721
23·1	1·92	...	...	...	...	...	...	62·944
23·4	1·95	...	...	...	...	...	...	64·172
23·7	1·97	...	...	...	...	...	...	65·444
24·0	2·0	...	...	...	...	...	...	66·656
25·5	2·12	...	...	...	...	...	...	72·999
27·0	2·25	...	...	...	...	...	...	79·541
28·8	2·4	...	...	...	...	...	...	87·619
30·0	2·5	...	...	...	...	...	...	93·156

For measuring furrows or canals when it is not desired to go to the expense or trouble of erecting a gauging weir, the following rough rule will be useful. This rule is not accurate for all cases, but, if used carefully, it will give fairly good results.

Select a straight reach of the furrow or stream with as even a grade as possible, having a uniform cross-section free from rubbish. The furrow should be straight and uniform for about 40 or 50 feet.

Near the lower end of the reach mark off a run, say 20 feet, by means of sticks on the banks. The sticks should be put on each bank so as to mark off two straight lines at right angles to the furrow. In the centre of the run, that is, 10 feet from each end, mark off a third line in the same manner.

Determine the cross-section of the furrow by measuring the depth of water *at regular intervals* across the furrow. The sum of these depths multiplied by the regular interval will give the area of the cross-section. All measurements should be taken in feet and fractions or decimals of a foot.

To find the mean velocity throw a piece of wood into the *centre* of the stream about 10 feet above the upper mark (A). When the piece of wood passes the upper mark, note the time by the second's hand of a watch. When the piece of wood reaches the lower mark (B), 20 feet lower down, note the time again, and the difference between the two times will give the time taken by the float to traverse the 20 feet of run. The float should always travel in the *centre* of the furrow.

Repeat this six times and take the mean by adding all the results together and dividing by six.

To ascertain the velocity of the water in feet per second, divide the length of the run (i.e. 20 feet) by the average time *in seconds* taken by the float to travel the 20 feet. Thus, suppose it took ten seconds for the float to travel the 20 feet, then in one second the water would travel twenty divided by ten, or two feet per second.

This is the central surface velocity, and to find the mean velocity multiply the result by 0.7.

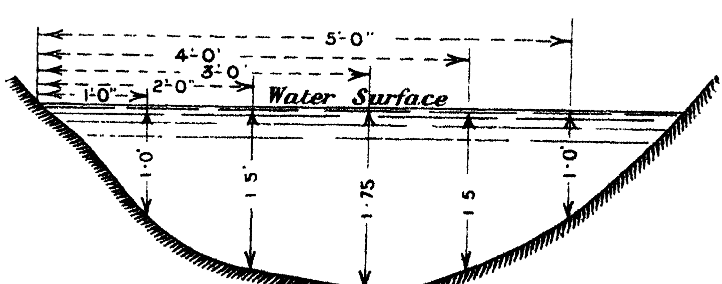
The mean velocity in feet per second multiplied by the area of the cross-section in square feet will give the discharge of the furrow in cubic feet per second.

EXAMPLE.

Assume that the run has been laid out as described above. The operator then proceeds to measure the area of the cross-section of the middle section.

At one foot from the left bank the depth of water is 1 foot.
at two feet it is 1 ft. 6 ins., or 1.5 ft. ;
at three feet it is 1 ft. 9 ins., or 1.75 ft. ;
at four feet it is 1 ft. 6 ins., or 1.5 ft. ;
at five feet it is 1 ft. ;

and the breadth of the furrow at the water surface is 6 feet, the regular interval being one foot, thus :—



The sum of the depth is :—

1
1.5
1.75
1.5
1

6.75

The cross-sectional area is thus :—

6.75 × 1 (regular interval) = 6.75 square feet.

Now throw a piece of wood into the centre of the furrow above A, and note the time it takes to travel from A to B. Repeat this six times, and tabulate the times thus :—

1. Time = 15 seconds
2. „ = 17 „
3. „ = 14 „
4. „ = 16 „
5. „ = 15 „
6. „ = 16 „

93 ÷ 6 = 15½ or 15.5 seconds mean time.

This is the time taken to travel 20 feet; the central surface velocity is, therefore, 20 ÷ 15.5 = 1.29 feet per second. The mean velocity is thus :—

1.29 × 0.70 = 0.903 feet per second.

The discharge of the furrow is thus, the area multiplied by the mean velocity :—

6.75 × 0.903 = 6.095 cubic feet per second,
say 6 cubic feet per second.

One cubic foot of water per second, running for 12 hours, is—1 cubic foot × 12 hours × 60 mins. × 60 secs. = 43,200 cubic feet. So that a flow of one cubic foot per second will cover an acre almost one foot deep in 12 hours, or three inches deep in 3 hours.

That is to say, a flow of one cubic foot per second will give an acre a 12-inch watering in 12 hours, or four acres a 3-inch watering in the same time, or one acre a 3-inch watering in 3 hours.

In all calculations of this sort, care should be taken that similar units are always employed in the same calculation. Thus, to obtain the flow of a stream in cubic feet per second, all the measurements must be in feet and fractions, or decimals of a foot, and all time must be expressed in seconds.

For the better understanding of discharges, expressed in cubic feet per second, the following data may be useful :—

One cubic foot per second equals 6.24 gallons per second.
„ „ „ „ 374.3 „ per minute.
„ „ „ „ 22,464 „ per hour.
„ „ „ „ 539,136 „ per 24 hours.

3,600 cubic feet per hour
86,400 cubic feet per 24 hours
one cubic foot per second will cover an acre
12 inches deep in 12 hours.
6 „ „ 6 „
4 „ „ 4 „
3 „ „ 3 „

The Management of Agricultural Shows.

By Matt. Lochhead, Secretary, Transvaal Poultry Club.

Having visited all the principal Agricultural Shows throughout South Africa, and finding so much dissimilarity in the manner in which they are conducted, it occurred to me that the adoption of some uniform methods was much to be desired. Uniformity would not only mean a considerable decrease in the work of the secretary, but it would add greatly to the convenience and pleasure of the general public, who find different conditions prevailing at every show which they visit. Exhibitors, too, would find their plans much more easily carried out, were they to know that the same conditions govern the secretarial arrangements at each show. With a view to arriving at some scheme which would, in the first place, render the work of the secretary during show time much easier and the results of his operations more accurate, and, secondly, with a desire to consider how the visiting public might more easily follow the judging at shows, I have carried out certain ideas at the different shows held under the auspices of the Transvaal Poultry Club during the past season, and feel confident that the suggestions which I now make will be appreciated by those responsible for the running of Agricultural Shows. The adoption of the system hereinafter described at our show in June was a marked success. The ease with which the work was got through, the absence of the usual worry with the printer, the manner in which the public expressed their appreciation of attention paid to their requirements, the eulogies of the Press, all went to prove that the introduction of different methods than those usually adopted were urgently required. I am conscious, of course, that the suggestions made are open to improvement in many matters of detail, but in the main the scheme may be taken as a framework on which to build up a more perfect organisation. It may appear at first sight that the adoption of such a system involves a considerable expense, but it will be found that that expense is more than counterbalanced by the saving in time and labour, and by ensuring absolute accuracy in the catalogues, and ultimately in the published reports of shows.

Receiving Entries.

The real work of the Secretary starts when the entries begin to come in, and unless system is adopted right from the beginning there is bound to be confusion sooner or later. The method universally in use is to have one book, known as the show book, in which all entries received are posted. This single book has been the means of putting the whole organisation of a show out of gear right from the start. It is wanted immediately the entries close for the printer's list, it is wanted to number and arrange the accommodation of exhibits at the show ground, and it is wanted by the secretary. All three cannot possibly have it at the same time, and here my first suggestion meets the difficulty.

Before the entries begin to come in the secretary should order from his printer quarto books in triplicate, two of the pages being perforated. These books should be ruled as follows:—

CLASS 87.

BEST FRIESLAND BULL (IMPORTED).

First Prize, £5: *Second Prize*, £3; *Third Prize*, £1.

EXHIBIT NO.	DESCRIPTION OF EXHIBIT.	PRIZE AWARDED.
354	J. J. van Niekerk's "Kruger II."	1st.

As the entries begin to come in, carbon sheets are placed between the pages, and three copies made from one impression. A Bates' numbering machine will number in triplicate, and this can be done by a junior, or the printer may do it. Each section should have a book of its own, and in the event of there being a rush—as there usually is—a large staff can be put on and the work got through in little time. The quarto sheets should be ordinary printer's paper, and the ruling—it is advisable to have them ruled—may be done by letterpress. Ascertain from your printer what the price of these books would be, and you will be surprised that they cost so little, considering the amount of time they save and the accuracy they guarantee. When your entries close, one of the sets of perforated sheets can be torn out and handed to the printer; the other perforated pages should be stitched together, with a coarse paper cover (your printer will charge you nothing for it), and kept for reference at the show ground, the secretary being left in undisturbed possession of the original. There is surely nothing elaborate or unwieldy in such an organisation, and the expense of it is a mere bagatelle.

When the awards come in—which will be dealt with later—the column marked "Prize awarded," filled in by the chief steward, is kept by the secretary as his official record.

The advantages of having separate books for each section are many. The steward in charge of a particular section keeps his own book from the time he has started to arrange his exhibit cards, and always has it at hand for reference in the event of any questions arising.

LATE ENTRIES.

The practice of receiving late entries has become common through dire necessity. All show committees are desirous of making as much from their entries as they possibly can, many of them to keep their balance on the right side of the ledger. It is, however, a practice which cannot

be too strongly condemned, as most of the irregularities that occur and most of the troubles of secretaries are due to some member of the committee asking "as a great favour" that the entries of a particular friend of his should be accepted after the advertised time for closing. I should advise all secretaries to fight against this practice as persistently as they can, and if they must receive them, have them printed at the end of the catalogue as an appendix, charging extra for them. Never neglect this latter advice.

The sending out of exhibitors' numbers is an easy matter when the sectional book system is adopted.

Judges' Books.

Having posted all entries and sent your "copy" to the printer, the next care of a secretary is to get his judges' books ready. This is again simplified by having one show book for each section. The form which I recommend (the size I will deal with later) is the following :—

BLOEMFONTEIN AGRICULTURAL SHOW.

Class..........

(to be judged)

Nos. ....

....

....

1st ....

....

2nd ....

....

3rd ....

....

4th ....

....

H.C. ....

....

....

Judge.

Judges' books should all be printed in duplicate, the steward bringing the carbon paper forward with each class judged. The perforated original should be torn out at once and sent to the secretary's office by runners (boys). The extra line underneath the space for the exhibit number will be explained in the next paragraph. It will be observed that a 4th prize is inserted instead of a V.H.C. Might I suggest that V.H.C., H.C., and C. be relegated to the limbo of the forgotten and obsolete past. What does V.H.C. mean but 4th prize, and so forth, and if it means 4th, why not call it 4th. This is only by the way.

Telegraph Board.

The suggestions which I make under this head do not fall directly under the category of duties of a secretary, unless we are to take the broad view that a secretary must consider the public as much as he does himself or the exhibitors. In fact, a little more attention to the comfort of those who make the "gate" would not be out of place, and from exhibitors and the public generally the adoption of the telegraph board has received full appreciation where it has been used.

One of these boards will be found sufficient for each section. They are ordinary blackboards (may be made of flooring boards), divided off into squares the size of your judges' slips. There is no necessity for the judge to carry a volume about with him ; in fact, the fewer encumbrances he has the better he is pleased. The size of the judges' books which I have adopted are 3 in. x 5 in.—quite large enough for the biggest class. The squares on the board are made 3 in. x 6 in. full. One inch is allowed at the top for affixing the class number. These numbers can be obtained from your printer. They should be printed on gum paper, the size of the numbers being about ¾ in., leaving ⅛ in. top and bottom when cut out. When your entries close, ascertain the classes that are filled, give a list of these classes to a boy, and get him to gum the numbers on top of the squares. The classes in which there are no entries are omitted. The boards for the Transvaal Poultry Club I made myself, so the only cost was the price of the flooring boards and a couple of pounds of paint.

Receiving Judges' Awards.

Herewith I give an illustration of one of the boards I suggest :—

JUDGES' AWARDS. SECTION "N."

54	55	56	59	60	61	63	64	65	66	67
68	69	70	75	76	77	78	79	80	81	82
83	84	85	86	87	88	89	90	91	92	93

As I have stated above, runners should be told off to bring the slips from the judges' stewards to the steward in charge of the section. Three boys can cover a very large show. The section steward posts the awards

into his section book, and has the names of the winners filled in on the judges' slips on the line provided underneath the winning numbers. He then hands them to a steward in charge of the telegraph board, who affixes them with a drawing pin in the square underneath the number of the class. The public and exhibitors can then see at once the awards that have been made, and the steward can also tell at a glance what classes have been judged and what are still to be judged. It will thus be seen that it does not matter whether the classes have been judged in the sequence of the catalogue or not; the slips go into the spaces allotted to them a minute after receipt by the steward. Any mistakes are easily discerned and as easily rectified.

Press Reports.

The lot of the gentlemen of the fourth estate is not the most enviable during an agricultural show. Where there are two or three newspapers striving to be first in the field with a complete list of the awards, and where they are trying to obtain these with as much accuracy as possible, the position may be imagined when it is borne in mind that there is only one show book, which is posted from the judges' slips or from his book when he has entirely finished his judging. In most instances the secretary does not post his book until the show is over, so that five or six perspiring reporters have to vie with each other for possession of the judges' books immediately they arrive at the office. A little forethought, a little extra trouble, and the secretary will receive the benedictions of the Press; the reports of the judging will be absolutely correct, and the pressmen need only occupy their time getting a general report of the show. This is how it is done:—

When your entries close, go through your show book, take a schedule, and mark the classes that are filled and the number of entries in each. Now take three or four (according to the number of newspapers requiring reports) foolscap pages of thin paper, place sheets of carbon paper between each, and proceed to make typewriter copies as follows:—

Horses.

(*Thoroughbreds.*)

1. Best Stallion, imported or otherwise.

1..................2..................3..................

2. Best Mare, imported or otherwise.

1..................2..................

and so on.

(Note that No. 1 has 1st, 2nd, and 3rd; that is because you can see from the number of entries that only three awards can be made. No. 2 has only 1st and 2nd. There are only two entries.)

Make different sets of sheets for each section. Having completed your lists (a good typist should do a large show in two days), fasten them all to a table with drawing pins with the sheets of carbon between. Now all is in readiness for starting the judging. When the judges' slips begin

to be brought in by the runners, the steward in charge of the section, having entered the awards in his section in the show book and placed the name of the winner on the space provided, hands the slip on to the press steward, who in turn copies the names on to the sheets which he has prepared, making five or six copies with one impression. The slip is then, as before described, fixed on the telegraph board. I have mentioned a press steward, but such an official would only be wanted in a very large section, or where the judging is got through quickly. In most sections one steward can easily do the entire work of entering the awards in the show book, making press copies, and fixing on telegraph board, and still have spare time.

Does this seem too much trouble for the secretary? He is not required to make these sheets himself. If he has a typewriter he may find time to do them; if not, he can surely find someone with a modern typewriter and an accommodating philanthropic disposition to do them for him. If neither, any typewriter agency will do them at a price which will not make a very big hole in the finances of the show. He will be amply repaid for any little trouble he may have been put to by receiving the benedictions of a magnanimous Press. He will be able to supply authentic copies of the results of the judging one minute after the last animal or article has been judged, and he will be satisfied that the reports which will appear will be as correct as it is humanly possible to make them; that is unless the steward in charge of the section is devoid of the ordinary modicum of common intelligence. Let me once more say that there is no theorising in these suggestions; they have been tried with most gratifying results, and have been declared a complete success by the Press and all interested.

Prize Cards.

There are many methods adopted for placing the award cards over winning exhibits, but most of them involve unnecessary waste of time. Some secretaries make the cards out before the show, arrange them in sections, and give them to the judges' stewards to affix when the award is made and the card signed by the judge. This not only naturally involves the writing out of a large number of cards that may never be used, and an unnecessarily heavy printer's bill, but it is apt to cause confusion and lead to mistakes being made. Other secretaries, again, write out the cards during the show when the judges' slips come in, and send a steward round to place them in their proper position. The judge does not see the cards put up, and so many mistakes occur.

Exhibitors who pride themselves on their successes usually make a point of collecting their cards at the close of the show, and, although they are torn and dirty, they are treasured as something to show to prove their wins. The weak points in the foregoing are obvious. What is required is that award cards corresponding to the entry which the judge has made in his judge's book shall be placed on the exhibit in his presence, and that the exhibitor at the close of the show shall receive his cards whole and clean.

How does the following appeal to secretaries? Before the show have a number of slip cards, 2¼ in. x 6 in., with FIRST, SECOND, THIRD, etc., printed in bold letters as follows :—

Prize Cards will be forwarded to Exhibitors.
FIRST.
No............ .... *Judge's Initials.*

Each judge's steward is provided with a sufficient number of these to cover the entries in his section. When the judge makes a first award, the steward produces one of these cards, inserts the number of the winning exhibit in the corner, and gets the judge to initial the card. It is then affixed in the presence of the judge. Proper prize cards are made out by the secretary after the show, and forwarded to the winners by book post. A halfpenny stamp will carry almost all the cards which any individual exhibitor may win. The many advantages which accrue from the adoption of this system cannot be too clearly emphasised. In the first place, the judge sees that the cards are properly placed; the number in the corner (which should be made with indelible pencil) is sufficient to prevent changing of cards; the secretary has no office worry regarding the making out of cards during the show, and the exhibitor has the pleasure of receiving his cards in a presentable condition.

I would like also to see all shows adopt the same colours for prize cards, and there can be no reason why the old recognised colours should be depared from. They are—

First.	Second.	Third.	Special.	Other Awards.
Red.	Blue.	White.	Yellow.	Any tint.

There is much in the organisation of the general requirements for a successful show that call for special consideration and improvement, but for the present I trust that these few hints to secretaries will serve a useful purpose.

The Wool Industry and its Improvement.

BY H. GELDARD.

IT is pleasing to note that a much greater interest is now being taken by farmers in South Africa in sheep-breeding and wool-growing, and perhaps a few notes regarding English wool buyers will be acceptable. The common practice amongst South African sheep farmers of selling their wool to local storekeepers, and the necessity of the storekeepers paying as much to one man as to his neighbour, irrespective of the value of the wool, and the consequent lack of knowledge of the sheep farmer of requirements of the European wool-users has so far been the greatest drawback to the proper development of the wool industry in South Africa.

An adequate knowledge of the requirements of your market, and attention to those requirements is necessary in order to obtain the best price for anything you may have for sale, and this applies with equal force to the sale of wool as to any other branch of trade, yet the sheep farmer in South Africa has so far been more or less content to throw his wool on the market indifferent as to whether it suited the user's requirements or not, thus damaging his own interest and bringing South African wool into bad repute. But for the enormous shortage in the world's supply of wool, the sheep farmer of this country would have to accept a much lower price for his wool so long as these practices are adhered to.

Many farmers, particularly in the Transvaal and Orange River Colony, are now endeavouring to improve their sheep and the value of their wool by more advanced and up-to-date methods, and by importing fresh blood. Much, however, remains to be done before South Africa can take its proper place as a wool-producing country.

Almost all the world's supply of wool finds its way to the London quarterly sales. These sales are largely attended by buyers from all parts of England—the town of Bradford being well represented—the Continent, and America.

Some time before the sale the buyer will arrive to look over the lots offered, and with the list sent him giving full particulars of mark, number of bales, country of origin, etc., goes on a tour of examination. The bales are all cut open and shown under a glass roof. Here the careless methods of the South African farmer are fully exposed, and should a buyer intend bidding for any wool, he marks with his private mark the price he is prepared to go to, and naturally (as he is not buying soiled wool) allows for what he sees.

We will suppose that the wool is bought, and goes from the sale to the merchant or topmaker. After being received in the warehouse it is sorted, blended with other wool of the same quality, and is then sent by the merchant to the commission wool comber, where it is washed, scoured, and combed. The combing machine separates the "Top" (long-stapled wool) from the "Noil" (short wool), and when this process is completed the wool is returned to the merchant in the form of tops and noils, and with a small percentage of waste. The merchant also receives from the comber a "Result," i.e. a complete table showing what wool was received: Quantity of tops made, quantity of noil made, and the loss that has been incurred in going through the various processes. The merchant can calculate pretty accurately from the "combing result" as to whether the

lot will be payable or not. Should the wool make more noil than top, or the percentage of waste be more than calculated upon, the merchant stands to lose money. (See Plate 3.)

The top is spun into yarn, called "Worsted Yarn," and on account of its length can be made into a great variety of fabrics; worsted yarns being woven into materials for women, worsted suitings for men, hosiery, etc. The noil, being only useful for certain articles of manufacture, such as blanket-making, hatting, is not so valuable as the top.

On noting the following "Comparison Results," which are typical of those observed by the wool-buyer when buying for top-making purposes, some conception of the influences which affect the price of raw wool will be obtained.

It is perhaps necessary to point out that the price of the finished article "the Top"—provided this is in all cases of the same quality—does not differ very greatly in either Cape, Australian, or South American materials, but is due to the various losses experienced in carrying the raw wool through the processes of manufacture, and according to the extent of each of these losses the price of wool varies considerably.

* * * *

COMPARISON OF SOME TYPICAL SAMPLES OF AUSTRALIAN AND CAPE WOOLS.

A. (1) *Cape* :—

	Per Cent
Yield of clean wool	36
Proportion of top present (long-fibred material) ..	31
Proportion of noil (short wool) . ..	5
(or 6 to 1).	
Value of noil, per lb.	18½d.
Value of top, per lb.	27d.
Cost of combing, per lb.	2d.
(on top returned to owner).	
Value of greasy wool, per lb.	7¾d.

(2) *Australian* :—

	Per Cent
Yield of clean wool	53
Proportion of top	47
Proportion of noil	6
(or 8 to 1)	
Value of noil, per lb.	18d.
Value of top, per lb.	27½d.
Cost of combing, per lb.	2d.
Value of greasy wool, per lb.	12d.

B. COMPARISON OF QUALITY.

	Cape.	*Australian.*
Length	Good.	Good.
Strength	Fair.	Good.
Colour	Very good.	Good.
Fineness	Very good.	Very good.
Softness	Soft.	Soft.
Elasticity	Fairly elastic.	Very elastic.

Plate 3. [Photo by Professor Barker

Preparing and Combing Wool in the Bradford Technical College, Yorkshire, England.

1. Greasy wool. 2. Washed wool. 3-7. Preparing. 8. Combed wool. 9. Finishing gill. 10. Top. 11. Noil.

GET UP, I.E. THE ARRANGEMENT OF FLEECES, PACKING, ETC.

Cape.	*Australian.*
Poor.	Very satisfactory.

The price paid for greasy wool depends on :—

(1) *The amount of clean wool* yielded when the greasy wool is scoured, which depends on the quantity of impurity present. It will be noticed from the result that the Cape wool gives only 36 per cent. clean wool, or a 64 per cent. loss, while the Australian gives 53 per cent. clean wool, or 47 per cent. loss. Because of this difference in weight of clean wool after scouring the buyer can pay more for Australian than for South African wool.

(2) *The proportion of top to noil.*—

The value of top—the long-fibred material—as shown, is almost double that of noil. Consequently, that wool clearly defined in staple, free from deteriorating impurity, and uniform also, is most sought after. And as the cost of combing is governed by the "Tear"—i.e. the proportion of top to noil—a greater price has to be paid for the noiliest wool, and additional reduction in the price offered for wool is often made on this account.

Here again it will be noted that the Cape yields six top to one of noil, while Australian yields eight to one.

(3) *The quality of the wool.*—

It will be seen on studying quality—*comparison table B*—that South African wools are below Australian wools in the features of strength and elasticity. These—particularly the strength—account for the reduced value of the Cape top, and, consequently, in part for the reduced value of the wool.

(4) *The value of the noil.*—

Here Cape wools occupy a premier position. The noils from this wool, owing to their whiteness and fineness—these qualities suiting them to the best hatting and other trades, command a slightly higher price than those from other types of wools. The noils are also a "Credit" influence in top-making, that is, they lessen the cost of the "Result," and it is no doubt due to these being of an improved quality that the price of Cape wool is what it is, and not lower.

(5) *The get-up of wool.*—

South African wools are not well got up. Insufficient skirting is done ; the packing of fleeces is unsatisfactory. Thus allowance is always made by the buyer for lack of *uniformity* of quality and the "sorting" or "looking over" which must also follow, to the disadvantage of the Cape grower.

* * * *

I would submit the following suggestions as being worthy of consideration by those interested in the production of the best Transvaal wool, and as being of the highest practical importance to the users :—

(1) *The amount of dirty, impure wool must be greatly lessened.* Grease present in wool acts as a preserving agent, and is therefore valuable, but

dirt is of no value whatever, and its presence gives rise to the following objections :—

(*a*) It is most difficult to estimate the yield.

(*b*) Dirt often irreparably discolours the wool by long contact with it.

(*c*) Dirt disarranges the staple ; it also absorbs much of the grease preservative from the fibre, and thereby makes it weak. Any weakness of fibre, combined with disarrangement of staple, results in :—

(1) Heavy noilage during combing.
(2) Bad spinning.
(3) Decreased durability of the finished article.

(2) *Breeding.*—

South African wools as a rule are too loosely bred ; more density needs to be bred into the wool, even though this be done at a slight expense of its fineness.

At present South African wool is not strong enough to successfully spin into yarn anything near the extent it ought. Again, what is mostly required to-day is wool of about 60s. to 64s. quality, of good length, strength, and fineness in staple, and not of a fineness which ceases to be useful because it has not the strength compatible with its fineness. Care should, however, be taken in producing strength of fibre that too much quality is not sacrificed.

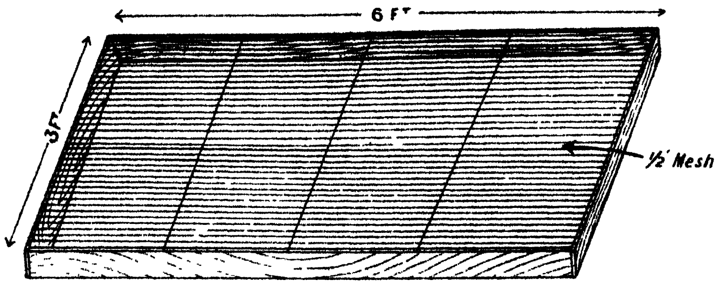
In breeding denser wool much can be done to keep out the dirt and other impurities, and while the importation of sound Australian sheep is to be commended for improving wool, the practice of buying rams indiscriminately without a knowledge of where they spring from is, in my opinion, to be condemned, as it should be the object of every sheep farmer to breed uniformity of type and quality in his wool.

(3) *Shearing.*—

This should be carefully and well done. If possible (as in this country good shearers are scarce) shear with a machine. Should shearing be done by hand, let a good man be employed. Wool shorn by careless natives is full of second cuts (which makes noil), whilst the sheep are often cut and knocked about. Shear off the belly first, then take off the rest of the fleece in one piece ; do not throw it on the floor, but transfer it direct to the sorting table. Let your shearing shed be clean, and shear only once a year.

(4) *Sorting.*—

This should be done at the same time as the shearing. The illustration shows a simple sorting table, which will be found sufficient for all requirements. This screen is the ordinary portable article used by builders for screening gravel, sand, etc.. The wire screen itself can be obtained from most stores or builders for about 20s. The four wood sides are made of one-inch plank, which anyone can knock together. For wool-sorting the screen is laid on a firm table, and when sorting the dirt, rust, etc., falls through on to the table. All dirt, etc., that accumulates under the screen should be destroyed, being liable to carry disease.



WOOL SORTING SCREEN.

The fleeces as they come from the shearer should be laid flat on the screen, and well skirted. Put these pieces into a bale or basket, and class the fleece wool into *first* or *second* combing, taking into consideration quality and strength. When classed, roll up the fleece inside out, and carefully and evenly pack it into a bale. Never under any circumstances tie a fleece with string. When all fleeces are skirted and packed, it is advisable to take the skirtings and bellies over the screen again, shake out well, and throw all clotted pieces of dung, etc., away, then pack in separate bale.

Wool-classing, as done in Australia, into five and six qualities is necessary when flocks run into hundreds of thousands, but the average farmer in South Africa will find *three grades* sufficient.

(5) *Packing.*—

This should be done honestly, the finding of dung, dirt, stones, etc., in a bale is not readily forgotten by the merchant, who on future occasions naturally seeks another grower's wool, or at least gives only a reduced price. Fleece wool should be evenly packed, not more than 350 lbs. to 400 lbs. in a bale. In branding mark the bale with name and address in full. In South Africa, where so many initials are alike, it will pay the farmer who gets up his wool well to do this fully. Mark the description of the wool on the bale as shown below :—

JOHN SMITH,	JOHN SMITH.
Klip River,	Klip River.
Standerton.	Standerton.
1st Combing.	Locks and Pieces.

Stencils for marking are cheap, and last for years.

(6) *Disposal.*—

This is from the farmers' point of view the most important part of the business, and various plans have been suggested of late as to the best means of obtaining a higher price for wool. The objection of many sheep farmers to sending their wool to England is the length of time that they have to wait before they are paid for the wool. Others state they are more or less tied to the storekeepers and bound to sell their wool to them.

The latter objection appears to be merely a disinclination to shake themselves out of the old ruts.

The following method is suggested (a plan which has already been tried with success) as one way of disposing of wool to better advantage to those who need an immediate return.

Send the wool, say, either to Port Elizabeth or Durban to a reliable firm to put up for sale, with a reserve price fixed, with instructions to the firm that should the wool not reach the reserve price, to forward for sale to London. Arrangements can be made either with the firm or a bank to advance the money on the bill of lading. After sale in London, the balance would be paid, and after deducting interest on advance, railage, freight, insurance, etc., the farmer would find the difference in the price received for the wool against previous years sufficiently encouraging to go on in his endeavours to improve his wool. The average cost of sending wool to London from the Transvaal or Orange River Colony will work out at about 1¾d. per lb.

What has been done by the sheep farmers of Australia in improving sheep and the value of their wool can be done in South Africa. By utilising the best methods of handling and disposal, there is no reason why South African wool should not be as much sought after and bring as good prices as Australian wools do at present, alike to the benefit of the farmer and the country.

Modern Bee-Keeping.

By D. S. van Warmelo.

Like any other pursuit, or hobby, bees—in order to be profitable or interesting—require constant care and hard work, both mental and manual. The first requisite for the successful management of bees in movable frame hives is a knowledge of the inhabitants of the hive and their life-work. I shall, therefore, endeavour, in the interest of the prospective bee-keeper, to give a few hints on these points.

As soon as a swarm of bees has been hived, and is in working force, it is called a colony.

A colony consists of the queen, workers, and drones. The queen is the mother-bee, and is the only fully developed female in the hive, all the workers being undeveloped females. There is no king-bee, and the queen is fecundated by the drone, of which there are hundreds, and even thousands, present in the hive, except when their presence becomes a burden to the population—when the honey-flow ceases—at which time they are promptly despatched. For a short time a colony can do without a reigning queen, and generally the presence of the drones (the males) is not absolutely necessary for the individual colony; but no colony can exist without the workers, which fulfil all the manifold duties indispensable for the welfare and the continuity of the race. Their strength, in a populous colony, may, by artificial means, exceed the number of 75,000—about twice the strength of a strong colony in its wild state.

* * * *

The Queen.

In order to make up for the wear and tear of life—the workers not living longer than five or six weeks, when they are working very hard on the flowers—Nature has provided the queen with a marvellous prolificness. If necessary, she can lay more than 3,000 eggs per day. The strength of the colony, therefore, depends largely on the fertility of the queen; for, if she is weak, she fails to keep the brood-nest full of young bees at a time when the foraging workers are working themselves to death, and consequently these dwindle off, so that the colony is doomed to gradual extinction if she is not superseded by a more prolific one. In such cases of emergency, Nature has marvellously provided for the existence of the colony by giving the bees the power and the instinct to raise their own queen from an ordinary worker-egg laid by the queen.

Under normal conditions there are to be seen, in South Africa almost the whole year round, tiny worker-eggs on the bottom of cells. These hatch out in three days, and the larva is then fed on a whitish fluid for five days, after which time it is sealed over by the bees. Then having gone through some stages of transformation in this capped cell, it comes forth a fully developed bee on the twenty-first day. From such a worker-egg the bees have the power to breed a queen, instead of a worker, in the following manner:—

When they wish to supersede a poor queen, or when they intend to swarm, they construct one or more, or many, cells, much bigger than the worker cells, about three times their diameter and an inch in length, and

hanging vertically or diagonally downwards. Into such a queen-cell they carry a worker-egg, or the queen lays one, which hatches in three days. Then the bees feed this larva on a richer food, the royal jelly, and instead of on the twenty-first day—as would have been the case if the larva had been intended to be a worker—there comes forth on the sixteenth day quite a different being, a queen.

A wonderful transformation, indeed, brought about only by the enlarged cell and the richer diet. In almost every respect is the insect changed—in size, form, structure, and habits. She is much bigger than the worker, and more elegant in form; her wings are short, her legs long; she has a curved sting with short barbs, which she never uses except in a deadly battle with another queen, whereas the sting of the worker is straight and has longer barbs. Her ovaries are well developed and filled with eggs. She very seldom leaves the hive, is helpless, and is fed by the workers almost incessantly, especially when she is expected to lay many eggs; and she lives about fifteen times as long as the worker bee.

In the case of a queen that is to be set aside, the bees will allow her to remain in the hive until the young one begins to lay, and often for some time longer; but never will a colony brook the presence of a second queen when there is no honey coming in. In those cases where there is more than one queen in a hive all the year round, we always find that they belong to separately established colonies in a big hive. Those who have lately succeeded in introducing several queens safely into the same hive have found that all of them disappeared, except one, as soon as the honey-flow ceased.

Touching cross-fertilization, it may be mentioned that copulation takes place outside the hive in the open air.

A few days after she hatches, during the warmest part of the day, the queen goes out on her honeymoon trip, and will sally forth every day until she has met the drone. If, however, she does not meet the drone within about three weeks, she will remain unfertile. And now I wish to point out another wonderful law in connection with the queen, which is called *Parthenogenesis*. Usually, within ten days after hatching the queen begins to lay eggs, and will never leave the hive again except when the colony swarms. That is to say, the queen—without having been previously fertilised by the drone—is able to lay eggs from which drones hatch out. This is termed in Biology *a sexual reproduction*.

Some very good queens will attain the age of five years, but modern apiarists seldom allow their queens to see their third year, as they become less prolific after their second year, and consequently lay more drone eggs, or, as we have seen, unimpregnated eggs; the spermatozoa, or male germs, in her spermatheca, or seminal sac, becoming less in quantity and vitality.

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THE WORKER.

The smallest, and only industrious, bees in the hive (except the queen in her monotonous egg-laying existence) are the workers. The welfare and whole household economy of the hive is dependent on them. Amongst them is divided a vast variety of work in a manner that must claim our highest admiration. Even the very young bees get their share of the indoor work in the way of feeding the larvae, ripening the honey, and carrying it up and sealing it. The body-guard of the queen attends to her wants. Many fly out to gather nectar; some bring in pollen for the young or

propolis, or carry in water; others fill up all crevices or contract the entrance, if necessary, with propolis, or ventilate with their wings, or guard the entrance against enemies; others, again, cluster together in order to breed wax-scales from which the comb is made, and so forth.

As we have seen, the worker-larvae are, in comparison with the queen, fed on a spare diet, and hatch on the twenty-first day. Then they first crawl about helplessly on the combs, and soon give a hand indoors, but generally do not fly out on sterner duty before they are at least a week old, after having carefully noted a few days beforehand, while playfully flying hither and thither, the exact spot of their hive. During a heavy honey-flow they live on an average six or seven weeks, so hard do they work in order to get their hives well filled with honey before the season closes. In winter, especially in cold climates, where the bees are for a long time in a semi-dormant state, they may live for eight or nine months.

When bees sting, the barbs of the sting act like hooks, which cause it to be retained through the exertion of the bee to free itself. Authorities appear to differ on the point as to whether bees always die when they lose their sting, but I have reason to think that the loss of their sting is fatal to them.

Through lack of space I am only touching some of the principal facts in connection with bee-life, but there is one thing about the workers that I would like to point out here. Since the queen is bred from an ordinary worker-larva, it follows that the workers have the organs and qualities of the queen latent and undeveloped in themselves, which may, by stimulation, be exercised to such an extent that a worker may put the productive tendencies of the queen in practice by laying eggs, from which, naturally, only drones will hatch, the bee not having been fertilised. These eggs are always laid scattered and indifferently in the cells, sometimes five or six in one cell. The novice is, therefore, advised not to conclude from the presence of eggs that there is a queen in the hive, but to judge from the method in which the eggs have been laid.

There are some theories about these fertile workers, as they are called, but one thing is a plain fact, namely, that in the case of a queenless, hopeless colony, there is some method in the madness of the bees. In their despair they will feed a worker-bee compulsorily on the royal food in order to stimulate artificially its egg-laying powers.

An Italian queen—a little more than a day old—which I had carefully reared in a nucleus (a very small) hive, I could not find on the combs. On reopening the hive on the following day, I found to my astonishment the cell, from which the queen had hatched, sealed over again. I opened it in order to verify my conclusions. It contained two dead worker-bees and one live one. In my opinion there is no doubt but that these three bees were shut up by the others in order to force them to feed on the royal jelly, and that two were stung to death inside the cell. I have often wondered if bees had reasoning power, or whether such cases as these can be traced to inherited instinct, or are otherwise acquired characteristics accentuated by force of circumstance.

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THE DRONES.

The word drone has become proverbial in denoting a noisy laziness. About the only use drones have in the colony is that they, the males, are indispensable to the existence of the race. And this the bees must know, else they would hardly tolerate this necessary evil in their hives.

In spring, when honey is coming in, and when the bees have their prospects of increase by swarming, their means of prevention of over-population, they will begin the construction of drone-comb, and twenty-four days after the egg has been laid, the first drones will hatch, and soon commence to fly about buzzing loudly in search of virgin queens. They will come back, fill themselves with honey, and go out as often as they please, but never do a particle of work. The only redeeming quality they have, inside the hive, is of adding some warmth to the hive, which, however, if it becomes too great, the workers have to lessen by hard ventilating of the wings. Whenever there is a dearth of honey, the bees will mercilessly shove and pull them out of the hive, where they must get chilled and starve to death, except when the hive is queenless, or has a virgin queen, when several drones will be reserved for the eventual fertilisation of the queen bee. The drone is nearly as long as a full-laying queen, but is more bulky in appearance. It has no sting. Some people still have the mistaken notion that a worker-bee, which has lost its sting, becomes a drone, or water-carrier, as they call it.

The consumption of honey in South Africa is, comparatively, not so great as in some other countries, because bee-keeping is still in its infancy, and it is not easily procurable in an attractive form. Comb-honey is still an article of luxury. The public must be educated up to the use of it as a wholesome food by bee experts, members of bee-keepers' associations, and tradesmen, who should point out its value to them as a medicine or a substitute for sugar. Then the public will learn that granulation is about the surest test of its purity, and so less adulterated honey will be eaten. Judging from the stringent laws that have recently been passed in America against the adulteration of honey, a great deal of glucose must be eaten yearly in South Africa, imported and sold here in the form of liquid honey in bottles, sometimes with a piece of honey-comb in the centre, suggestive of bees, but deluding to buyers.

In 1906 more than 40,000 lbs. of honey were imported into the Transvaal, mostly from England and Australia; in 1907 only 28,000. This shows a considerable decrease in a year's time, most probably owing rather to the bad times than to the advance of apiculture in South Africa.

The Veterinary Section.

STRANGLES AND GLANDERS.

By C. E. Gray, M.R.C.V.S., Principal Veterinary Surgeon.

In this Colony, as in other parts of South Africa, the equine diseases known as strangles and glanders are not infrequently mistaken for one another by horse owners, and as the results of errors of this description often lead to considerable financial loss, and may be attended by serious consequences to those who make them, it may perhaps serve a useful purpose to give a short description of each disease, and afterwards to compare them and to indicate the most marked points of difference between the two.

"Strangles or Nieuwe Ziekte."

This disease is a specific febrile affection, affecting horses, mules, and donkeys, highly contagious in character, and caused by a micro-organism known as the Streptococcus equi, which was first identified as the cause of this disorder by Schutz. This disease has an incubation period of about four or five days, and in its most common form it assumes the character of a catarrhal inflammation of the upper air passages accompanied by marked fever and an abundant nasal discharge, generally from both nostrils, with swelling of the lymphatic glands in the vicinity of the throat and between the jaws, which usually terminates in the formation of an abscess or abscesses of considerable size. These abscesses if left to themselves usually break either internally or externally, discharging a considerable quantity of creamy pus; with the evacuation of the abscess the fever subsides and the animal speedily recovers.

Occasionally, when the disease is at its height, small ulcers make their apearance in the nostrils, and in such cases the nasal discharge may be streaked with blood, but if ulcers do form in cases of strangles they are healthy in character and generally heal rapidly. During the progress of the indisposition the patient generally coughs a good deal, and suffers from sore throat to such a degree that it eats and drinks with a considerable amount of difficulty, part of the food or water frequently returning through the nose when the animal attempts to swallow. This symptom is most marked when an abscess forms in the neighbourhood of the pharynx.

The disease usually takes this course, but in some cases, particularly where the hygienic surroundings are unfavourable, it may assume more malignant characters; abscesses may form in the liver, in the brain, or in the lymphatic glands of the lungs or intestines. In cases of this sort the bursting of these abscesses is attended by symptoms which lead us to suspect what has taken place, and death almost inevitably follows. In other instances a skin erruption appears in the course of the disease, which is accompanied by the formation of nodules or small abscesses,

which generally make their appearance in organs where the skin is thin, in the vicinity of the muzzle, sometimes along the side of the face, and sometimes in the region of the scrotum or mammary glands. These abscesses, which are of small size, generally heal in a healthy manner, unlike the lesions of cutaneous glanders.

Strangles is a disease which is most common in young horses, and one attack generally confers a certain degree of immunity, but animals of all ages may become infected and may suffer from it more than once. Susceptible animals generally contract it by coming into contact with nasal discharge of those suffering from the disease or by drinking from contaminated buckets or troughs, or feeding from mangers previously used by infected animals.

In ordinary outbreaks, even when the disease is mild in character, although the mortality may not be high, it is often a cause of considerable loss to horse owners, as it often leaves behind it a chronic cough or affects the wind of the subject to such a serious extent that its usefulness is affected and its market value materially lowered.

Treatment.—In cases of this disease it is essential that an affected animal should be separated from those that are healthy, should be well sheltered from the weather, and, should the bowels show a tendency to be constipated, two or three ounces of epsom salts or glauber salts should be given daily in the drinking water. The food should be of a nourishing and unirritating character, green food being particularly indicated on account of its laxative effect on the bowels, while an occasional hot bran mash placed before the animals while it is still too hot to eat is often most beneficial, as the steam arising therefrom has a soothing effect on the inflamed and irritable mucous membrane of the air passages. Steaming the head is sometimes carried out by putting a nose-bag on the animal, from which the bottom has been removed, and holding the horse's head over a bucket of hot water, to which a little carbolic acid or creosote has been added, but it will sometimes be found that attempts at steaming increase the animal's distress and add to its difficulty in breathing, therefore in such cases this treatment should not be persisted in. But when the breathing is particularly laboured on account of the impending formation of an abscess in the vicinity of the larynx, the application to the external swelling of a paste of mustard and water mixed just as it would be if required for table use, or of a blister composed of one part of powdered cantharides to four of lard, or one part of biniodide of mercury to six of lard will often give marked relief. Sometimes poultices of linseed meal or bran are applied to these swellings, but there is always a considerable amount of difficulty in keeping such poultices in position, and they quickly become cold, so that unless they are changed frequently it is doubtful whether poultices do very much good. The same remark applies to the application of hot fomentations, which are occasionally tried as an alternative, unless they are persevered with and an abundant supply of hot water is obtainable.

When the swelling comes to a head and begins to show signs of softening, it should be opened as soon as possible, but if it is located in the vicinity of the larynx, or even when it makes its appearance underneath the lower jaw, the operation is one which should be conducted with a considerable amount of caution, as the careless use of the knife may lead to the wounding of one or more of the important blood vessels which

traverse these regions. If the owner decides to open the abscess instead of allowing it to burst spontaneously, the head of the animal should be steadied by putting a twitch on the nose, one of the fore feet should be picked up and held by an assistant; the skin should then be carefully cut through over the most prominent point of the swelling, making an incision about one inch in length, and the abscess should then be opened by thrusting the finger into the opening made by the knife till the abscess cavity is reached and the contents are evacuated. When the abscess has emptied itself it should be treated as a common wound, cleaned every day and dressed with an antiseptic lotion, a solution of Jeyes' fluid and water being perhaps as good as any, and in most cases it will be found that after this the animal speedily becomes convalescent.

It should be borne in mind that when strangles has made its appearance on a farm that no susceptible animal should be subjected to any avoidable surgical operation lest the wound should be accidentally infected by the organism of this disease. This warning especially applies to the operation of castration.

"GLANDERS."

Unlike strangles, glanders is a disease of a malignant character, attended by a very high mortality, and not amenable to treatment. The horse, mule, and donkey are all susceptible, the last-mentioned animals being perhaps more so than the horse. Other animals, such as the cat and goat, occasionally suffer from glanders, particularly if housed in stables in which the disease has established itself, and man himself may fall a victim to this disease. In human beings the disease is almost always acute, death generally resulting from glanders-pneumonia. Chronic cases in man have been known to occur occasionally, but I have not been able to obtain any authentic record of the recovery of any one who became infected with this disease.

Glanders is caused by a micro-organism known as the Bacillus Mallei, first described by Loffler and Schutz, which can be readily grown on artificial media, and which reproduces the disease when inoculated into susceptible animals.

Two types of glanders are commonly recognised:—First, the acute type, in which the progress of the disease is rapid, death generally occurring within a fortnight of the date on which the animal is first noticed to be ill.

Second, the chronic type, in which the illness may last for months or even for years, particularly when animals are living in dry climates and are well fed and protected from adverse influences.

To these two types of the disease may be added a third, the occult form, in which an animal may be affected and may show no external evidence of the disease for years, but may, on the contrary, appear to be in a condition of perfect health.

It is probably to animals of the latter class in which the disease can only to be detected by the application of the mallein test, to which many mysterious outbreaks of glanders owe their origin, the disease being most likely to manifest itself to the ordinary observer when the infected animal

is subjected to adverse influences, such as exposure, over work, or insufficient feeding.

The existence of the disease may be suspected in cases where the following symptoms are observed :—

In the acute form of glanders the attack is generally ushered in by symptoms of a chill. There is a marked elevation of temperature, 103 deg. F. to 105 deg. F., the animal is visibly out of sorts, disinclined to eat, the eyes are infected and a nasal discharge makes its appearance, at first thin and adhesive, later becoming purulent in character and streaked with blood, while the nasal mucous membrane becomes the seat of the following changes : Small discrete nodules of a greyish red colour and translucent character make their appearance ; these rapidly break down and become converted into shallow unhealthy-looking ulcers, which are frequently covered with a dirty yellow crust. These ulcers often become confluent and sometimes cover the greater portion of the visible mucous membrane, and so rapidly does this process go on that persons unacquainted with the character of the disease are frequently taken by surprise by the suddenness with which these ulcers develop and extend. As the ulceration progresses the breathing becomes interfered with and is accompanied by snoring, any manipulation of the nostrils causing the animal to snort, a fact which should be borne in mind by any person attempting to examine a suspected horse, as the act of snorting may lead to the violent ejection of nasal discharge which may enter the eyes of the examiner and expose him to the risk of infection. These changes in the nasal mucous membrane may be evident in one or both nostrils, and are accompanied by swelling and induration of the lymphatic glands situated between the jaws, which become enlarged on the same side that the ulceration has become established, and at the same time the lymphatic vessels along the side of the face may become corded, and small, unhealthy sores, which do not tend to heal, appear along their course. Coincidently with the development of these, there may be swelling of one or more of the limbs with thickening of the lymphatic vessels thereof, and with the subsequent appearance of sores of a similar character to those which have been already described.

As the disease progresses emaciation becomes more marked, the breathing becomes more laboured, and death generally occurs in two or three weeks of the time when the disease first established itself.

Before going on to describe the post-mortem appearances, it might be well to warn persons of an enquiring turn of mind against attempting to make a post-mortem of any animal which is believed to have been suffering from glanders if they have any cuts or abrasions on their hands or arms, as a post-mortem conducted under these circumstances might lead to the infection of the individual who carried it out.

The changes set up by the disease are generally most marked in the nasal chambers, in the windpipe, and in the lungs. In the first we frequently find a congested condition of the mucous membrane, with ulcers of a similar character to those seen in the nostrils during life ; lesions of a similar character are not infrequently found in the windpipe, while the lungs will be found to be the seat of inflammatory changes which have led to the formation of numerous tubercules which may be scattered throughout the lung substance ; these tubercles are of small size, about

the size of a lentil seed, with a greyish glistening centre surrounded by a ring of congested lung tissue. Tubercles are sometimes also found in the pulmonary lymphatic glands, which are in such cases enlarged and indurated, and occasionally also similar tubercles are found in the spleen, liver, and kidneys.

"Chronic Glanders."

Together with this may be described the condition popularly known as Farcy, which, to all intents and purposes, is a cutaneous form of glanders, in which the characteristic lesions of this disease develop along the course of the superficial lymphatic vessels of the skin. In cases of chronic glanders there is first generally a falling off in the condition of the affected animal, the appetite becomes capricious, the coat loses its healthy appearance and the animal may develop a cough ; later there may be a catarrhal discharge from the nose, sometimes from both nostrils, but most frequently unilateral. As time goes on small nodules, about the size of a hemp seed, with a whitish or yellowish centre, a greyish circumference, and surrounded by an area of congestion, make their appearance on the nasal mucous membrane. At a later stage these break down and are converted into small, unhealthy-looking ulcers which do not heal, or, if they do, they only heal very slowly. From the surface of these ulcers, which tend to involve the deeper layers of the mucous membrane, and which sometimes perforate the nasal septum, haemorrhages occasionally occur, causing the nasal discharge to be streaked with blood. At this stage the character of the nasal discharge becomes altered ; it becomes tenacious, adhesive, and somewhat like boiled starch in appearance, often making the nasal orifice on the affected side appear contracted and smaller than its neighbour, and while this change is proceeding the submaxillary lymphatic glands of the side on which the nasal ulceration has made its appearance becomes enlarged, indurated, and adherent to the inner side of the jaw, but does not generally display any tendency to suppurate. Occasionally there may be diffuse swelling of one or more of the limbs or a swelling may appear along the abdomen or on the chest wall, which subsides, leaving the lymphatic vessels of the part thickened and corded with small, unhealthy sores or buds distributed along their course, which discharge an adhesive and tenacious pus, matting the hair together over the sores. This condition, which is popularly known as Farcy, is not an uncommon complication in cases of chronic glanders.

An animal suffering from chronic glanders may live for months, or even for years, and if well sheltered and fed, and living in a dry atmosphere the subject may remain in fairly good bodily condition for a considerable length of time, but sooner or later the animal's constitution becomes undermined, and an attack of acute glanders supervenes with fatal results.

Treatment.—Nothing need be said of the treatment of animals suffering from glanders. As soon as an animal shows symptoms which lead the owner to suspect the presence of glanders in his stable, the matter should be reported immediately to the Government Veterinary Surgeon, who will be able, with the assistance of the mallein test, to separate affected animals from healthy ones, and advise the owner as to the steps to be taken in order to effectually disinfect his premises.

Points of Difference between these Diseases.

An owner may suspect the existence of *glanders* in any animal whose appearance is unthrifty, which suffers from a cough, which has a unilateral nasal discharge with or without nasal ulceration, with induration of the submaxillary lymphatic glands, and if unhealthy sores make their appearance in various parts of the body, particularly when these lesions are persistently present for weeks or months without showing any disposition to heal. On the other hand, if an animal, particularly a young animal, suffers from a nasal catarrh with severe sore throat and the formation of a large sensitive swelling in the intermaxillary space or in the vicinity of the larynx, which terminates in the formation of an abscess which discharges a large quantity of creamy pus and afterwards heals rapidly, and from which the animal makes a speedy and complete recovery, there is every likelihood that the disease from which the animal has suffered was *strangles*, but if an owner is in any way doubtful, or whether he is doubtful or not, he will do well to report the case to the Government Veterinary Surgeon, as surgical assistance is frequently necessary in order to relieve an animal suffering from strangles, and if the case should be one of a more serious character the sooner the owner knows the truth about it the less risk there is of the animals doing harm to other equines or to human beings.

THE INOCULATION OF SHEEP AGAINST BLUE-TONGUE AND THE RESULTS IN PRACTICE.

By Dr. Arnold Theiler, C.M.G., Government Veterinary Bacteriologist.

Some few years ago Mr. Spreull, M.R.C.V.S., of the Cape Colony, introduced a method of immunising sheep against blue-tongue by means of a serum and virus inoculation, and I conducted some experiments at this laboratory on the lines he indicated. Whilst passing the virus through numbers of sheep I noticed that after the tenth generation the mortality from the inoculation completely ceased, as shown in the following table:—

Generation of Virus.	Number of Sheep Injected.	Number of Deaths during Injection.
1	11	1
2	7	2
3	4	1
4	3	1
5	3	1
6	3	0
7	12	0
8	11	1
9	13	2
10	32	1
	99	10

Generation of Virus.	Number of Sheep Injected.	Number of Deaths during Injection.	Remarks.
11	49	0	
12	19	0	
13	41	0	
14	23	0	
15	39	0	
16	99	0	
17	202	0	One sheep died forty-two days after inoculation.
18	138	0	
19	72	0	
20	64	0	
21	58	0	
22	32	0	
23	25	0	
24	2	0	
25	4	0	
26	4	0	
27	12	0	
28	2	0	
29	2	0	
30	4	0	
31	2	0	
32	2	0	
33	2	0	
	897		

These results induced me to abandon the simultaneous serum and virus injection, and I introduced the vaccination method. The vaccine was obtained from the eleventh generation upwards, and of the 897 sheep injected none died during the treatment, and the temperature charts showed that all animals passed through a typical blue-tongue reaction. That is to say, the temperature would, on an average, rise from the fifth day, reaching the maximum of 105° F. to 106° F. on the ninth day, then falling daily, reaching a normal record on the fourteenth day.

Amongst these 897 sheep vaccinated at the station, clinical symptoms were rarely noticed, although occasionally a slightly abnormal discharge from the nose was present, and perhaps a slight swelling of the lips, but in no cases were lesions noted in the mouth, or redness of the lips, or excoriations of the mucous membranes or tongue, or in the feet (lameness, for instance). Of course these vaccinated sheep were stabled under the best conditions. In practice, however, where the sheep are not stabled at all, or only kraaled, and where they are exposed to the weather, some severe reactions must be expected. In such cases the general opinion amongst farmers is that from the tenth to thirteenth days after vaccination sheep show distinct symptoms of illness, lie down, appear to be lame, and when

they finally rise show stiffness; in addition to this, catarrhal symptoms in the nose and swellings of the lips are noticed, but only in exceptional cases are sore lips and sore gums noted. The illness passes over within two or three days, and the animals seem to recover from the effects of the reaction very quickly.

SEASON 1906-07.

In February, 1907, this vaccine was introduced into practice, and, although it had been thoroughly tested on the station, I wished to compare the results in practice, and considered this first introduction in the light of an experiment. Accordingly the vaccine was issued free of charge to all applicants, and, as far as possible, syringes were lent for the operation.

We received a slight set-back at the commencement, as in one case in the Waterberg District a heavy mortality occurred amongst the vaccinated sheep. On investigation it was found that at the time of vaccination heavy rains were experienced, and the vaccinated sheep lying in the kraals contracted blood poisoning owing to the mud, etc., entering under the skin through the puncture caused by the vaccination. It must be explained here that blood poisoning is seldom caused if dirt enters an open wound to which air has free access, it is only when this dirt or mud gets under the skin, where it sets up a swelling, that blood poisoning follows. Our directions for use were accordingly amended, and all applicants were instructed not to vaccinate during or immediately after heavy rains.

At the end of the season statistics were asked for as to the results obtained, but unfortunately only a small percentage came to hand, which are given hereunder. The deaths following vaccination have been divided into those occurring (1) within nine days from inoculation, (2) from the tenth to fourteenth days, and (3) after fourteen days from inoculation, the reason for this being that the whole course of blue-tongue averages fourteen days, and this period must therefore be allowed for the reaction consequent on the vaccine before immunity is finally established. An animal already suffering from the disease at the date of vaccination would probably die within nine days. Deaths occurring between the tenth and fourteenth days are considered as a result of vaccination, and the vaccine is probably responsible.

Mortality after the reaction has finished, that is to say, from the fourteenth day onwards, has been considered as a sequel of the disease.

As in many instances farmers did not inoculate their whole flock, statistics were also collected as to the mortality amongst the non-vaccinated animals, and, for the purposes of comparison, have been embodied in the following return:—

RETURNS OF MORTALITY AMONGST VACCINATED SHEEP AS COMPARED WITH MORTALITY OF NON-VACCINATED SHEEP RUNNING ON THE SAME FARM.

District.	Vaccinated Sheep.				Non-Vaccinated Sheep.		Percentage of Deaths amongst	
	Number Vaccinated.	Number which died within 1 - 9 days.	Number which died within 10 -14 days.	Number which died after 14 days	Number.	Number which died.	Vaccinated Animals.	Non-Vaccinated Animals.
							per cent	per cent.
Ermelo ...	1,906	12	17	2	3,228	336	0·9	10·
Heidelburg ..	423	1	0	2	3,542	283	0	8·
Middelberg ...	142	39	6	0	2,204	599	3·0	27·
Lydenburg ...	966	0	1	3	2,289	200	0·1	9·
Marico ...	36	1	0	0	400	16	0	4·
Waterberg ...	1,200	0	0	0	Not	stated	0	-
Rustenburg ...	11	0	0	0	Not	stated	0	—
Pretoria ..	1,065	19	1	0	Not	stated	0·1	—
Barberton ..	10	0	0	0	130	Nil	0	0
Standerton ...	106	2	1	0	4,425	383	0·9	0
Volksrust .	10	0	0	0		—	0	-
TOTAL ...	5 875	74	26	7	16,218	1,817	0·4	11

Naturally these figures only represent a small minority of the sheep in the Transvaal and the number vaccinated during the season, but the return is accurate as regards the statistics at my disposal, and the results may safely be considered as typical for the Colony.

The percentage of deaths amongst vaccinated sheep amounted to 0.4 per cent., and amongst non-vaccinated animals to 11 per cent. That is to say, for every sheep which died during inoculation, about twenty-seven non-vaccinated sheep succumbed to natural infection.

SEASON 1907-08.

I considered these results very encouraging, and accordingly made arrangements to meet all requirements for the 1907-08 season. The following instructions for use were distributed to applicants, together with a memorandum giving the names of firms willing to supply syringes, and the prices charged:—

"DIRECTIONS FOR THE USE OF BLUE-TONGUE VACCINE FOR THE SEASON 1907-08.

This vaccine may be obtained on application to any Government Veterinary Surgeon, or to the Government Veterinary Bacteriologist, P.O. Box 593, Pretoria, at a charge of 1d. per dose, ten extra doses being added gratis to every hundred doses ordered.

The utmost care is exercised in its preparation, but no guarantee is given nor will compensation be paid for any deaths or accidents which may follow its use.

Hypodermic syringes for carrying out the inoculations may be obtained from the firms whose names are given on the attached list. Syringes which are provided with a graduating wheel on the plunger bar are recommended as being most convenient for use. With care such syringes will last for several years.

The greatest care must be taken to prevent the contamination of the vaccine or the syringe by dust or other foreign matter.

Vaccine should *be* unpacked, *kept in a cool place till required for use*, and should be used within fifteen days from date of arrival.

When the vaccine is unpacked, examine it, and if any bottles show leakages or have broken corks they should be returned to the Government Veterinary Surgeon or the Government Veterinary Bacteriologist.

Do not inoculate the whole flock immediately the vaccine arrives, but first of all inoculate about twenty of the flock with the smallest bottle of vaccine as soon as possible after the vaccine is received.

The operation of vaccinating is very simple, but should be carried out carefully according to the manner laid down herein.

First the syringe should be disinfected; to do this place some cotton wool or cloth in the bottom of a clean tin, basin, or pan, and fill this with water; take the syringe to pieces, unscrewing the metal cap at the top of the glass barrel; place on top of the cotton wool in the pan, together with the needle, and place the pan on the fire. After the water has boiled for about ten minutes, take the syringe out and screw it up, and fit the needle to it.

Next obtain a clean glass tumbler or cup and wash with boiled water; then uncork the bottle of vaccine in some place where dust is not likely to enter it, and pour some into a cup, placing a clean piece of paper over the glass so that it extends about half-way down, and forms a cap. After pouring out the vaccine recork the bottle immediately, and do not return to the bottle any vaccine which has been poured into the cup, and which may be left over after inoculation.

Once a bottle has been opened, all the vaccine should be used the same day.

The sheep which are to be inoculated should be prepared for the operation by washing the inside surface of the thigh, where the vaccine is to be injected, with an antiseptic solution made by adding 1½ tablespoonfuls of Jeye's fluid, or Little's dip, or carbolic acid to one whisky bottle full of water. The operator's hands should be washed in the same solution, and a small quantity should also be kept in another vessel, with which the syringe and needles should be washed from time to time.

The syringe should then be filled with vaccine, the animal to be inoculated should be taken out of the kraal, the needle should be inserted under the skin inside the thigh—after the skin has been washed in the manner prescribed—and one cubic centimetre of the vaccine should be injected. Turn the animal loose after the operation, but keep it separate from those which have not been vaccinated. A little uneasiness will be shown by the animal after the vaccine is introduced under the skin, but this soon passes off. For the first few days after injection the sheep should be kept on dry ground, and not allowed to lie in dusty or muddy kraals.

Never vaccinate sheep in kraals, or during rain, or immediately after a heavy rain, and if the day is windy inoculate the animals at the windward side of the kraal in which the non-vaccinated animals have been placed.

Neglect of these precautions may lead to contamination of the vaccine or of the wound, and may set up blood poisoning. After inoculating, the syringe should be carefully washed in the antiseptic

solution and should be wiped dry before being put away. Ten days after the first twenty sheep have been injected, if there is no sign of swelling at the seat of the inoculation, the remainder of the flock may be inoculated. The sickness set up by the inoculation begins about nine days after, and lasts a few days. Immunity against natural attacks of blue-tongue is not established for fifteen days after inoculation.

N.B.—Ewes heavy in lamb should not be inoculated.
Lambs over six weeks old should not receive more than half the dose for ordinary sheep.
Lambs under six weeks old should not be inoculated.
Rams should not be castrated while undergoing reaction, nor should castrated animals be inoculated before the wounds caused by castration have completely healed."

(The instructions for season 1908-09 have been amended. See page 37.)

The total number of doses issued in the Transvaal between September, 1907, and February, 1908, amounted to over 90,000, whilst over 100,000 doses were distributed amongst the other South African Colonies. Considering the number of sheep in the Transvaal, the issue of 90,000 doses does not seem very high, but it must be remembered that last season was not a severe one for blue-tongue, and many farmers refrained from vaccinating on this account. It is a peculiar fact that the majority of farmers waited for the disease to break out before vaccinating their flock, notwithstanding our repeated directions to the effect that the vaccine has no curative value on animals suffering from blue-tongue. The absence of heavy rains last season appears to corroborate our theory that the carrier of the blue-tongue micro-organism is a biting insect which requires water for its development.

It has been impossible to collect statistics with regard to 1907-08, although with but a few exceptions, which are detailed later, no untoward reports have been received, and the results of the vaccine have proved eminently successful.

Loss of Condition.

This would appear to be the only complaint that can be brought against the vaccine, and even then one that can be easily prevented. The vaccine was introduced into practice for the first time in February, 1907, and discontinued in April. It was reintroduced in October, 1907, although the bulk of the vaccine was applied for in November, December, January, and February. The vaccination undoubtedly pulls sheep down in condition slightly, in the same way as a natural attack, and those vaccinated after December would have to recover from the reaction under adverse climatical and grazing conditions. It is, therefore, advisable for sheep to be vaccinated early in the spring, so that they would be able to thoroughly recover during the summer months, and be in good condition to withstand the winter.

ABORTION.

Some cases of abortion which occurred amongst vaccinated ewes were reported from the Cape Colony, Heidelberg and Volksrust districts. Although the mortality in these cases was below 15 per cent., the matter was of great importance, and a full investigation was made. The reports to hand showed that the rams were put to the ewes about a month before the latter were vaccinated. Cases of abortion commenced within a month from the date of vaccination, and some dead lambs were thrown at the usual lambing time. With regard to these dead lambs, in all cases they were not full grown.

On first sight it would appear that the vaccine exclusively was responsible; but it must be borne in mind that these are only a few cases out of some 220,000 sheep that have been vaccinated, and even admitting that the vaccine was incriminated in some way or other, I am of opinion that another agency must have been acting at the same time.

Numerous other farmers vaccinated their sheep after they were put to the ram, without any mishaps, and in the Heidelberg district a farmer reported that the ewes commenced lambing directly after vaccination, and continued right through without any untoward results. (Another farmer insisted that the vaccine had caused the majority of his ewes to give birth to twins!)

For the future, however, it would be advisable to avoid running any possible risks, and all ewes should be allowed to recover from the effects of the vaccine before tupping. That is to say, vaccinate the flock at least a fortnight before turning the rams amongst the ewes.

DIARRHŒA.

In the Orange River Colony a case was reported where, amongst a flock of vaccinated sheep, a few died showing all the lesions of blue-tongue, and, in addition, those of diarrhœa. In this instance it is difficult to say whether diarrhœa was only a symptom of blue-tongue. as in very severe cases of this disease such may sometimes be the case. It is, however, more likely that at the time of the blue-tongue reaction the sheep were suffering from some intestinal complaint, which, together with the reaction, caused the deaths. It must be expected that when a large number of sheep are inoculated, all kinds of coincidences may occur, and it is sometimes difficult to say whether deaths in such cases are due to the coincidental complaint alone, or to the concurrent blue-tongue reaction.

LOSS OF WOOL.

The question has been raised whether the vaccine causes sheep to lose their wool, and, if so, the argument naturally follows that it is better to lose sheep from blue-tongue than to vaccinate and suffer heavy losses owing to the quality and low price obtained by the sale of the wool. I have not received any reports to this effect, and I do not consider that any apprehensions need be felt on this point, if my recommendations are carried out, as no such case occurred here on the station amongst our vaccinated sheep, but, at the same time, it stands to reason that as the vaccinated sheep pass through an attack of blue-tongue and show signs of illness, even though slight, the growth of the wool may be retarded, and this would naturally be more pronounced the later the sheep were inoculated.

Dipping.

A few losses have been observed in cases where sheep have been dipped for scab whilst undergoing or shortly after the blue-tongue reaction. It has to be expected that under these conditions one or the other animal will develop more severe reactions, and the effects of this in conjunction with the dipping may be responsible for deaths.

Season 1908-09.

For the ensuing season vaccine will be ready for issue about the middle of September, and all farmers who wish to vaccinate their flocks should make early application through the Government Veterinary Surgeon of their district. A copy of the following instructions will be supplied to all applicants:—

"Directions for the Use of Blue-tongue Vaccine for the Season 1908-09.

Read this Carefully.

This vaccine may be obtained on application to any Government Veterinary Surgeon at a charge of 1d. per dose.

The utmost care is exercised in its preparation, but no guarantee is given nor will compensation be paid for any deaths or accidents which may follow its use.

Hypodermic syringes for carrying out the inoculations may be obtained from the firms whose names are given on the attached list. Syringes which are provided with a graduating wheel on the plunger bar are recommended as being most convenient for use. With care such syringes will last for several years.

The greatest care must be taken to prevent the contamination of the vaccine or the syringe by dust or other foreign matter.

Vaccine should *be* unpacked, *kept in a cool place till required for use*, and should be used within fifteen days from date of arrival.

When the vaccine is unpacked, examine it, and if any bottles show leakages or have broken corks they should be returned to the Government Veterinary Surgeon.

The operation of vaccinating is very simple, but should be carried out carefully according to the manner laid down herein.

First the syringe should be disinfected; to do this place some cotton wool or cloth in the bottom of a clean tin, basin, or pan, and fill this with water; take the syringe to pieces, unscrewing the metal cap at the top of the glass barrel; place on top of the cotton wool in the pan, together with the needle, and place the pan on the fire. After the water has boiled for about ten minutes, take the syringe out and screw it up, and fit the needle to it.

Next obtain a clean glass tumbler or cup and wash with boiled water; then uncork the bottle of vaccine in some place where dust is not likely to enter it, and pour some into a cup, placing a clean piece of paper over the glass so that it extends about half-way down, and forms a cap. After pouring out the vaccine recork the bottle immediately, and do not return to the bottle any vaccine which has been poured into the cup, and which may be left over after inoculation.

Once a bottle has been opened, all the vaccine should be used the same day.

The sheep which are to be inoculated should be prepared for the operation by washing the inside surface of the thigh, where the vaccine is to be injected, with an antiseptic solution made by adding 1½ tablespoonfuls of Jeye's fluid, or Little's dip, or carbolic acid to one whisky bottle full of water. The operator's hands should be washed in the same solution, and a small quantity should also be kept in another vessel, with which the syringe and needles should be washed from time to time.

The syringe should then be filled with vaccine, the animal to be inoculated should be taken out of the kraal, the needle should be inserted under the skin inside the thigh—after the skin has been washed in the manner prescribed—and one cubic centimetre of the vaccine should be injected. Turn the animal loose after the operation, but keep it separate from those which have not been vaccinated. A little uneasiness will be shown by the animal after the vaccine is introduced under the skin, but this soon passes off. For the first few days after injection the sheep should be kept on dry ground, and not allowed to lie in dusty or muddy kraals.

Never vaccinate sheep in kraals, or during rain, or immediately after a heavy rain, and if the day is windy inoculate the animals at the windward side of the kraal in which the non-vaccinated animals have been placed.

Neglect of these precautions may lead to contamination of the vaccine or of the wound, and may set up blood poisoning. After inoculating, the syringe should be carefully washed in the antiseptic solution and should be wiped dry before being put away. The sickness set up by the inoculation begins about nine days after, and lasts a few days. Immunity against natural attacks of blue-tongue is not established for fifteen days after inoculation.

With a view to avoiding all risks, and in order to become acquainted with the method of vaccination, it is recommended that about ten to twenty sheep should be vaccinated in the first instance, and if there is no sign of swelling at the seat of inoculation within fifteen days, the remainder of the flock can be inoculated. This procedure is not absolutely necessary, but is advisable for the mentioned reasons, and the results will serve as an indication of the symptoms to be expected when the remainder of the flock is done.

N.B.—Ewes in lamb must not be inoculated.

Lambs over six weeks old should not receive more than half the dose for ordinary sheep.

Lambs under six weeks old should not be inoculated.

Rams should not be castrated while undergoing reaction, nor should castrated animals be inoculated before the wounds caused by castration have completely healed.

Sheep introduced from other parts of the country should not be inoculated until fourteen days after arrival."

* * * *

In conclusion, I wish to emphasise one or two points upon which some farmers appear to labour under a misapprehension. All the vaccine is of one quality; that is to say, the material in one bottle does not pass sheep through a more severe reaction than that in another bottle. If on vaccinating the first twenty sheep only slight reactions are noted, and yet when the whole flock is done about ten

days later severe reaction, and, perhaps deaths occur, some other agency must be at work. It may be that between the two vaccinations blue-tongue has broken out, and in such cases the vaccine will not have any curative effect on sheep already suffering from the disease. This contingency can be avoided by carrying out my recommendations to vaccinate early.

Other cases occurred last season where the flock were affected with worms, and which, in conjunction with the vaccination, caused severe reactions and deaths. Again, sheep freshly introduced from other Colonies should not be vaccinated immediately after arrival, but, first of all, should be allowed to acclimatise.

As already pointed out, coincidences are possible, and must be expected, and the greater the number of sheep vaccinated, the more coincidences will naturally follow. If at the time of vaccination sheep are suffering from some invisible ailment, it will be brought out by the reaction, and the reaction may develop into very severe symptoms of blue-tongue, so that apparently an animal dies as a result of the vaccination. This can only be explained by accepting that the concurrent ailment is responsible for the development of the severe reaction. We base this opinion (1) on the observation that amongst the 897 sheep vaccinated at this laboratory, and of which very careful records were kept, no deaths occurred from the inoculation, the animals having been carefully selected, and were all in first-class condition when vaccinated, and (2) farmers state that as a rule the reaction from blue-tongue vaccine is not a severe one, and, in most cases, passes unnoticed.

It is our experience that where deaths occur amongst sheep shortly after, or even several months after vaccination, farmers are inclined to attribute this mortality to the inoculation in some way or other. It is difficult to state in every particular instance whether any connection is possible between the two, but in the great majority of cases we can safely reply in the negative.

The Chemical Section.

THE MEANING AND VALUE OF THE CHEMICAL ANALYSIS OF SOILS.

By R. D. Watt, M.A., B.Sc., Acting Chief Chemist.

The following shows the average composition of one hundred typical Transvaal soils, examined in our laboratories between 1st July, 1907, and 30th June, 1908, stated in the usual terms:—

I.—Stones removed by 3 mm. sieve	2·59	per cent.
Analysis of air-dry fine earth—		
II.—Moisture	2·40	„
III.—*Loss on ignition (organic matter, etc.)	5·84	„
IV.—Insoluble matter (sand, etc.)	79·88	„
V. Oxide of iron and alumina	11·06	„
VI.—Lime...	0·24	„
VII.—Magnesia	0·15	„
VIII.—Potash	0·19	„
IX.—Phosphoric acid	0·055	„
X.—Total	99·815	„
XI.—*Containing nitrogen	0·114	„
XII.—"Available" potash	0·0113	„
XIII.—"Available" phosphoric acid	0·0069	„

Now, such a statement can have little meaning for the average farmer, so that a short explanation of each item may be of interest and value to those who send samples of soil for analysis.

I—Stones.

The first item requires little explanation. The stones which do not pass through a sieve with holes about ⅛ of an inch wide are separated, weighed, and the percentage calculated. Many Transvaal soils are quite free from stones, and the great majority contain very few, though in exceptional cases we have found nearly 50 per cent.

The soil which passes through the sieve is ground still smaller, and the remaining items calculated in this "fine earth."

II—Moisture.

Before starting an analysis, the soil is spread out in a thin layer for several days until it becomes "air-dry." It still contains some moisture, however, and the amount of this is determined by finding the loss which takes place when a weighed quantity of soil is heated to the temperature of boiling water for some hours. The percentage of water thus obtained gives a rough idea of the water-retaining powers of soils. Sandy soils always contain least, and stiff clays and soils with much organic matter most.

III—Loss on Ignition.

This consists chiefly of organic matter derived from the decay of roots and other parts of plants, and from kraal and stable manure. Very few, even of our virgin soils, show any tendency to accumulate organic matter, with the result that their water-holding power is seriously lessened.

IV—Insoluble Matter.

This is the portion of soil which is not dissolved after treatment for two days with hot, strong hydrochloric acid. It consists chiefly of sand which is of no use as a plant-food, but which provides the necessary medium for the development of the plant-roots. The amount of insoluble matter gives a rough idea of the texture of a soil. Sandy soils contain more than 85 per cent., and clay soils usually under 75 per cent.

The next five items represent the amounts of the various substances dissolved by hot strong hydrochloric acid. There may be more of some of these substances present in the soil, but the amounts given include all that plants will be able to take out of the soil for many years.

V—Oxide of Iron and Alumina.

No attempt is usually made to separate these two items, as they are always present in more than sufficient amounts for the needs of plants. It is the oxide of iron which gives the reddish colour to so many of our soils, whilst the alumina (being derived from clay) gives a further idea of the texture of the soil. Over 15 per cent. of oxide of iron and alumina usually indicates a clay soil.

VI—Lime.

Lime is often present in our Transvaal soils in only very small quantities—in some cases so small that it can hardly be detected. This is unfortunate, as the uses of lime in the soil are so numerous and important. For, besides being an important plant-food itself, it helps to bring about many changes in the soil which make the other constituents more available, i.e. more useful to the crop.

VII—Magnesia.

Magnesia also forms part of the "food" of plants. Though it is often present in very small amounts, there is generally as much as a crop requires. It is desirable to have in a soil a larger quantity of lime than of magnesia.

VIII—Potash.

Potash is another very important element of plant-food. Fortunately, it is generally present in sufficient quantity in our soils, though in a few of a sandy nature there is not enough of it in an "available" condition, especially for such potash-loving plants as potatoes and tobacco.

IX—Phosphoric Acid.

Phosphoric acid occurs in soils in the form of phosphates. There is no single constituent of soils which is of such great importance to every kind of crop, and unfortunately it is almost always present in too small amount in our soils.

X—Total.

By adding together the last eight items, we ought to get nearly one hundred. The sum, however, generally comes a little under that amount, as there are always small quantities of other substances, such as soda, sulphates, and chlorides present, which it is not considered necessary to determine.

XI—Nitrogen.

Nitrogen chiefly occurs in the organic matter, and before a plant can make use of it, it has to be changed by "germs" or "microbes" into what are known as nitrates. These microbes have been found to be present in an active state in every Transvaal soil yet examined, except one or two wet "vlei" soils. Nitrates are very necessary to the growth of plants, and they are apt to be deficient in all soils which are poor in organic matter. A certain group of plants, to which belong all kinds of beans and peas, lucerne, clover, monkey-nuts, etc., obtain part of their nitrogen direct from the air by means of another kind of microbe present in little swellings on their roots, and such crops are valuable because they leave the soil richer in nitrogen than they find it.

XII—"Available" Potash.

This represents the amount of potash present in a soil which a crop can make use of immediately. It is found in the laboratory by treating the soil for a week with a one per cent. solution of citric acid. In England, the quantity of "available" potash considered necessary in a soil is at least 0.005 per cent. If less than this quantity be present, it is considered necessary to apply potash manures. In the Transvaal, perhaps, a slightly smaller quantity will do, and the majority of our soils come up to the standard.

XIII—"Available" Phosphoric Acid.

The amount of this is found in a similar way, and has a similar meaning. The European standard for "available" phosphoric acid is 0.01 per cent., and it is in this item that so many of our soils fall short, a large number of them containing less than one-fifth of that amount. In fact, it is little exaggeration to say that the majority of Transvaal soils are starving for phosphates.

As has been indicated, the important items in a soil analysis are organic matter containing nitrogen, lime, "total," and "available" potash, and "total" and "available" phosphoric acid. We have already seen that Transvaal soils, as a rule, contain sufficient "available" potash, but not nearly enough "available" phosphoric acid.

As to the other important ingredients, it may be interesting to quote Maercker of Halle's classification of German soils, which is as follows:—

Grade of Soil		Nitrogen.	Lime.	Potash.	Phosphoric Acid.
Poor	..	Below 0·05	Below 0·10	Below 0·05	Below 0·05
Medium	...	0·05 0·10	0·10 0·25	0·05 0·15	0·05 - 0·10
Normal	...	0·10 0·15	0·25 0·50	0·15 0·25	0·10 0·15
Good	...	0·15 0·25	0·50 1·00	0·25 0·40	0·15 0·25
Rich	...	Above 0·25	Above 1·00	Above 0·40	Above 0·25

According to this standard, our average Transvaal soil is just under normal as regards nitrogen and potash, but is only medium in lime and poor in phosphoric acid.

Similar average figures for the humid region of California approach pretty closely to the average for the Transvaal, as will be seen from the following:—

		Average Transvaal Soil.	Average Californian Soil. (Humid Region)
Nitrogen ...	...	0·114	0·120
Lime ...	...	0·24	0·11
Potash ...	...	0·19	0·22
Phosphoric Acid	...	0·055	0·11

The same deficiency in phosphoric acid is noted here, and though the average Transvaal soil contains more lime, it must be remembered that the higher average figure for this substance is largely accounted for by a few soils which overlie dolomite or other limestone formation.

The value of a chemical analysis then lies chiefly in giving an accurate idea of the plant-food material present in a soil, both in an immediately available form and as a store which can be drawn upon gradually by cropping.

Now comes the question of how deficiencies in plant-food are to be supplied.

The first remedy is thorough cultivation. The more a soil is moved about and kept open by cultivation the greater will be the amount of this store of plant-food rendered available. Cultivation may thus, to a certain extent, take the place of manuring.

But this is only true *to a certain extent*, for some of our soils are so poor that good crops can only be grown when the substances necessary to plant-life are supplied in the form of a *manure*. The value of a soil analysis here becomes very evident, for without such an analysis it is almost impossible to know in what substances a soil is deficient, and what kind of manure it is necessary to apply. If a soil contains enough "available" potash, but is poor in phosphoric acid, it will be of little use to apply a manure containing potash, and vice versa.

Kraal and stable manure supply a little of everything useful to plants that is likely to be deficient in a soil, and at the same time they improve its power of retaining moisture; hence its great value on any kind of soil for almost every kind of crop. Its chief defect is that it is comparatively poor in phosphoric acid, the very substance which is most deficient in our soils. It seldom happens that enough of this natural manure is available for all the crops grown on the farm, so that substitutes have to be resorted to in the form of artificial or chemical manures. A brief account of some of the most important of these may, therefore, not be out of place. Such artificial fertilizers are naturally designed to supply one or more of the substances on the oft-repeated list, viz., nitrogen, lime, potash, and phosphoric acid.

Those which supply nitrogen are nitrate of soda and sulphate of ammonia, which are both very soluble manures, giving a quick return. The former is, perhaps, best adapted to the Transvaal, as sulphate of ammonia requires a certain amount of lime in the soil to give its best results. It is difficult to give exact figures for the quantities of these manures to be supplied, as so much depends on the soil and crop. One hundred to two hundred pounds per acre may be taken as a guide.

The best form in which to apply lime to land is—white (not blue) "slaked" lime applied at the rate of *at least* 300 lbs. per acre.

Sulphate of potash at the rate of 100 to 200 lbs. is the most generally useful form in which to supply potash, especially for tobacco and potatoes. Other potash manures are kainit and muriate or chloride of potash.

Nitrate of potash supplies both potash and nitrogen, and is cheaper, owing to smaller cost of railage, than equivalent quantities of nitrate of soda and sulphate of potash.

The chief phosphatic manures (manures supplying phosphoric acid) are superphosphate, basic slag, bone ash, bone meal or bone dust, and dissolved bones. These are all usually applied at the rate of 200 to 400 lbs.

per acre. Of these manures, superphosphate and dissolved bones give the quickest return, and are undoubtedly the best form of phosphates for soils rich in lime. To get the full advantage from these manures, many of our soils require the previous addition of lime.

Basic slag, bone meal, and bone ash act more slowly. The first of these contains lime in addition to phosphates, and is, therefore, well suited to soils poor in lime. Bone meal is specially useful where land is continually under crop and no kraal or stable manure is available. In addition to phosphates, both bone meal and dissolved bones contain some nitrogen.

Besides these "simple" fertilizers, most manure merchants make up mixtures suitable for different crops—mealie fertilizers, tobacco fertilizers, etc.—most of which are very suitable, though they are a little dearer than a proper mixture of the manures already mentioned. Being chiefly Colonial produce, however, they are carried at a cheaper rate by the railways, and the farmer is saved the trouble of mixing them or applying them separately.

An interesting proof of the value of soil analysis is afforded by our experiment of the manuring of maize described in the July *Journal*. If the soil on which the experiment was carried out had been sent in for analysis and advice, we would have been forced to recommend a complete fertilizer, with the result that a large, and in a good season a profitable, increase would have been obtained.

NOTES FROM THE CHEMICAL LABORATORIES.

By R. D. Watt, M.A., B.Sc., Acting Chief Chemist.

I.—Nitro-bacterine.

We have received many letters of enquiry about nitro-bacterine from farmers and others owing doubtless to the prominence given to the subject in the Press. The effect of using nitro-bacterine is to cause the particular crop inoculated to obtain its supply of nitrogen from the air. As is elsewhere explained, it consists of millions of microbes which have the power of penetrating the roots of leguminous plants and forming nodules on them in which they live and multiply. In return for a home in the roots the microbes fix the nitrogen of the air and pass it on to the leguminous plant in a form in which it can be assimilated.

Now a great number of leguminous plants in this country, such as kaffir beans, cowpeas, and peanuts have, as a rule, abundant nodules on their roots naturally, so that it seems hardly likely that the inoculation of these crops will be of much use. There are others, however, such as lucerne (which have been recently introduced, and are not nearly allied to any native species), which frequently have no nodules on their roots at all, or only a few small ones. It is with these crops that the best results are likely to be obtained.

By sending 5s. 6d. to "Nitro-bacterine," Mowbray House, Norfolk Street, London, and specifying the particular leguminous crop which it is desired to inoculate, a packet containing enough to

inoculate five to ten acres of ground will be sent by return, with full particulars as to its use. It can also be got from the Secretary of the Transvaal Agricultural Union, P.O. Box 134, Pretoria.

Last season this division inoculated a large number of samples of lucerne seed for farmers with cultures similar to nitro-bacterine obtained from America. We have only had a few reports sent in at the time of writing, but these have been favourable.

We have ordered a fresh supply from England, and are now prepared to inoculate seed of the following plants for farmers free of charge, viz., lucerne, lupines, red clover, white clover, and vetches (tares).

We recommend inoculating only small quantities of seed at first, say enough to sow one or two acres of ground. This should be tested against uninoculated seed sown on the same class of soil. Should inoculation prove a success any quantity of lucerne land can then be inoculated by taking some of the soil from a depth of two to six inches from the inoculated plot, drying and powdering it away from the sunshine, and distributing it over and harrowing it into the soil which it is required to inoculate.

As lucerne in its early stages is much benefited by some form of phosphate, we recommend farmers sowing lucerne this season to carry out this experiment on plots of any size, which suits their convenience, viz.:—

One plot with uninoculated seed and no manure.
One plot with uninoculated seed and 300 lbs. superphosphate (37 per cent.) per acre.
One plot with inoculated seed and no manure.
One plot with inoculated seed and 300 lbs. superphosphate (37 per cent.) per acre.

The plots should be separated by ridges so as to prevent the irrigation water from washing the manure or microbes from one plot to another. If the plots are not too large, and farmers are willing to accurately weigh the produce of each cutting, we are prepared to supply them with the seed and manure necessary for such an experiment if they furnish us with the results for publication. I should like to see the experiment carried out on as many farms as possible, as the results would prove of immense interest and value to lucerne growers.

Growing crops of lucerne can be inoculated by watering the plants with a solution containing the microbes or by moistening soil or sand with the solution and proceeding as described above for inoculation by means of soil. We are willing to send out to bona fide farmers a limited quantity of such culture solutions, free of charge, with full directions as to the mode of application.

II.—Variation in the Composition of Cow's Milk.

In the July number of the *Agricultural Journal* (p. 547) attention was called to the variability in the composition of cow's milk due to differences in the intervals between milkings. We recently determined the percentage of butter-fat in three samples of milk obtained from the same cow at three milkings on the same day with the following result:—

Sample.	Time of Milking.	Interval.	Yield of Milk.	Percentage of Fat in Milk.
1	6.30 a.m.	13 hours.	5½ quarts.	1·45
2	1 p.m.	6½ "	4¼ "	2·40
3	5.30 p.m.	4½ "	3½ "	4·50

It will be seen that the longer the interval the greater the yield of milk, but the poorer the quality. The average percentage of fat in these samples is unsatisfactory, but more uniform percentages would doubtless be obtained if the intervals between milkings were more equal. Except just after calving, it is unnecessary to milk cows more than twice a day, and the intervals should be as nearly as possible twelve hours.

III.—Two Abnormal Soils.

Transvaal soils are generally poor in lime, and it is not often that we have to record cases of soils exceptionally rich in this ingredient. We have, however, recently examined two soils—one from Potgietersrust and one from near Zeerust—which contain far too much lime.

The following is the result of our analyses:—

	Potgietersrust Soil.	Zeerust Soil.
Moisture	2·21	1·50
Loss on ignition (chiefly carbon dioxide) ...	35·95	13·76
Insoluble Matter	15·10	3·87
Oxide of Iron and Alumina	4·64	0·57
Lime	40·80	49·08
Magnesia	1·30	1·15
Potash	0·03	trace
Phosphoric Acid	0·01	0·03
	100·10	99·96

The samples consisted largely of carbonate of lime (chalk), the former soil containing 72.85 per cent., and the latter 87.64 per cent. of that substance. Such soils would hardly repay cultivation, but would be useful for carting on to soils in the neighbourhood which are poor in lime. Curiously enough soils which are very poor in lime often exist quite close to limestone formations. For instance, a red soil which we examined from the same farm as the Potgietersrust chalky soil only contained 0.11 per cent. of lime.

IV.—Oil Content of Sunflower Seed.

Two varieties of sunflower seed have recently been submitted to us for a determination of their oil content.

One was the Giant Russian (striped) variety, and the other a small black variety. The latter proved the richer in oil, as will be seen from the following figures:—

	Giant Russian Variety.	Black Variety.
Number of seeds in one pound ...	3,360	6,610
Husk	50·6 per cent.	43·4 per cent.
Kernels	49·4 „	56·6 „
Percentage of oil in kernels	33·2 „	36·7 „
Percentage of oil in whole seeds ...	16·5 „	20·8 „

The striped variety contained a considerable number of empty husks, which partly accounts for the low percentage of kernel. It is too early to pronounce the black variety the better, as the plants were grown in different districts, and it is never fair to judge from a single analysis. The two varieties will be grown side by side next year, when their cropping powers and oil content can be better compared.

THE INGREDIENTS OF "PLANT FOOD."

By R. D. Watt, M.A. B.Sc., Acting Chief Chemist.

It is a fact becoming daily more recognised that success in any undertaking depends largely on knowledge. A better understanding of the requirements of plants ought therefore to help every farmer in his growth of crops. In this connection the first thing to grasp is that plants are living things which eat and drink, marry and reproduce in quite as real a sense as animals do. This every cultivator realizes in a more or less vague sort of way, and many would like to have a clearer insight into what exactly is going on.

The following experiments were designed to throw some light on what plants require in the way of food or, to be more correct, "food material." The exact substances required have been known for a considerable time, and the first experiment w s designed by the writer to show how a plant fares when deprived of any of the necessary ingredients of its "diet." The method adopted was that of "water-culture," i.e. the plants (barley) were grown in vessels containing water to which were added small, carefully weighed, quantities of the substances known to be necessary to plant life. Now this is a rather unnatural way in which to grow ordinary farm plants, but it has the advantages of showing the root development, and of the possibility of supplying the plants with exact quantities of different substances. During the growth of the plants the glass cylinders were kept in the dark, and only the leaves and stems exposed to the light in imitation of nature's plan. (See Plate 4.)

Pot 1 contained all the necessary ingredients, and it will be seen that the barley plant grown in it reached maturity and produced grain.

Pot 2 had added to it exactly the same substances as Pot 1, except that no combined nitrogen was supplied. The barley grew quite vigorously at first, but when the nitrogen contained in the seed was exhausted the plant died of nitrogen starvation.

Pot 3 was exactly the same as Pot 1, except that phosphoric acid was left out, with the result that there was practically no root-development, and here, too, the plant soon died off.

Pot 4 contained no potash, and though the barley grew for a considerable time it showed no tendency to produce grain.

Pot 5, with no lime, produced a plant which also grew quite vigorously at first, but gradually got weaker and died of lime starvation.

Pot 6, which has no magnesia, caused the best growth of all, except No. 1, but it also failed to reach maturity.

It is reasonable to conclude from this experiment that the food materials which a plant must get from the soil are at least combined nitrogen, phosphoric acid, potash, lime, and magnesia. I may add that the solutions also contained a small amount of iron and some sulphuric acid in the form of a sulphate, and this completes the list of food materials which plants obtain from the ground in which they grow, with the exception of some non-essential substances such as silica, soda, and chlorine.

Now although no soil is absolutely devoid of any of these substances it can readily be imagined that a deficiency of any one of them in the soil will result in feeble plants and a poor crop. The difference between a barren and a fertile soil indeed is that the latter is much better supplied with all the necessary ingredients in an available form than the latter, and the aim of the cultivator is to see that his crops are not starving for want of one of more of them.

This is not the whole story of the food supply of plants, however, for if the plants in these experiments had been analysed it would have been found that the greater part of their material was made up of substances not on the above list at all. The other part of the story, which is perhaps the most important fact in nature, concerns the farmer less because he has so little control over it. It is this, that the green leaves of plants under the action of sunlight can build up from the carbon-dioxide which they absorb from the air and water absorbed through the roots substances which form the basis of all plant and animal nutrition.

It was mentioned in the previous article that phosphoric acid or phosphates had perhaps a greater influence on the growth of plants in general than any other substance. Our second water-culture experiment gives an indication of one of the functions of phosphates, viz., the encouragement of root-development. Here again (see Plate 5) we have five barley plants

Pot 4 contained an ordinary water-culture solution, and is indeed identical with Pot 1 in Plate 4.

Pot 1 here contained exactly the same substances as Pot 4, except that phosphoric acid was omitted.

Pot 2 contained 1-10th of the quantity of phosphoric acid given to Pot 4.

Pot 3 ½ as much, and

Pot 5 twice as much.

It will be seen that the development of the stem and leaf increased with the increasing quantities of phosphoric acid, except that Pot 5, which had an excess of phosphoric acid, showed no advantage over Pot 4, which had the normal quantity. The influence of the increasing quantities of phosphoric acid on the *roots* is much more marked, the development being pretty nearly in proportion to the phosphoric acid supplied.

It would be unwise to draw hasty conclusions from this experiment, but it is certainly suggestive. It is well known that superphosphate, which contains phosphoric acid in a soluble state, has a great effect in giving a young plant a good start in life, with the result that it matures early and produces a big crop of grain or seed, and this may be largely due to the early influence of phosphoric acid in encouraging root-development.

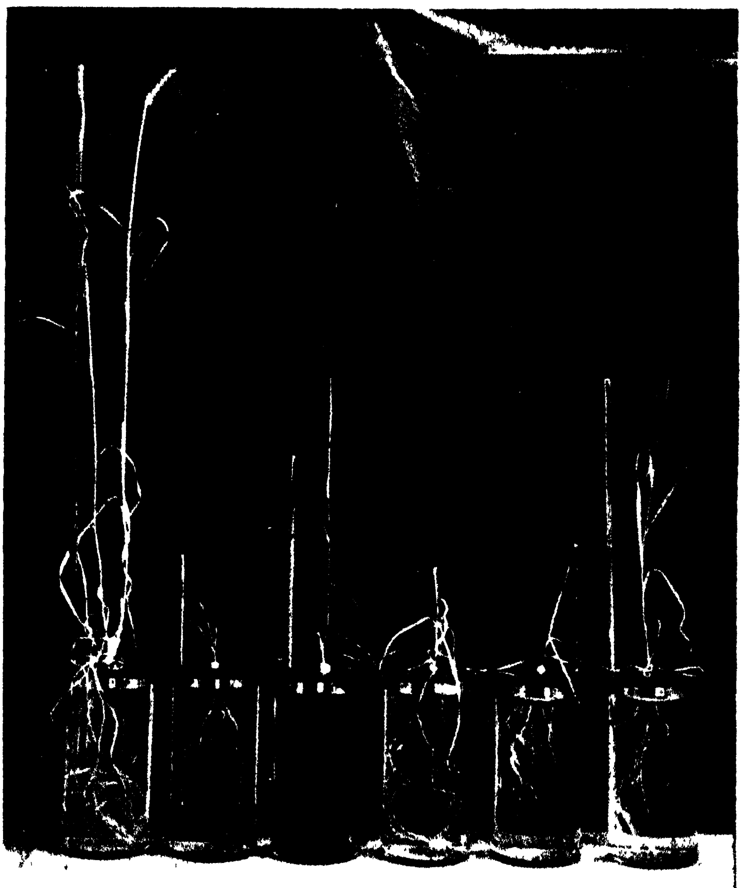
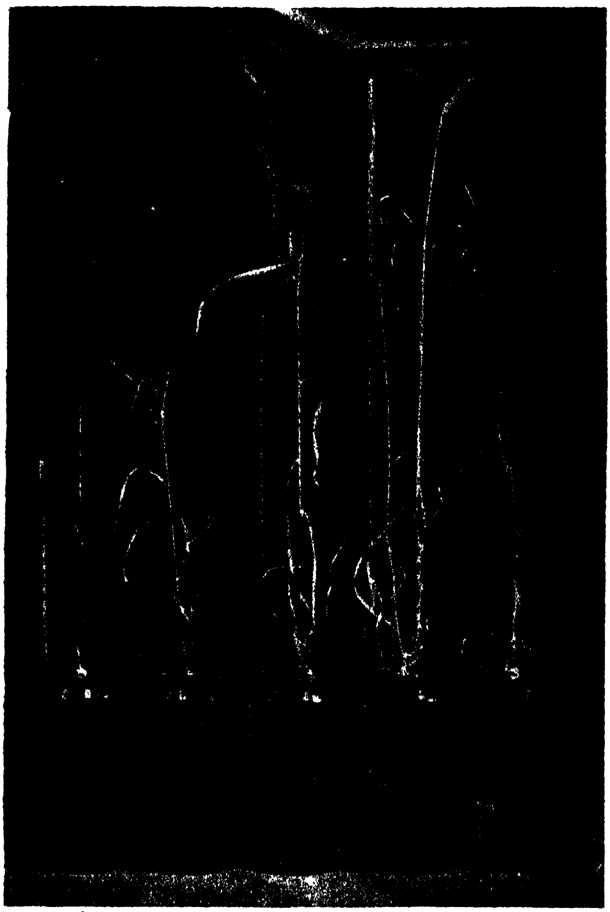


Plate I

Water Cultures of Barley.

1 Complete "food" solution.
2 No nitrogen.
3 No phosphoric acid
4 No potash
5 No lime.
6 No magnesia



1 2 3 4 5

Plate 5.

Effect of Phosphoric Acid upon Root Development of Barley in Water Cultures.

1. Solution contains no phosphoric acid
2. " " $\frac{1}{10}$ usual amount of phosphoric acid
3. " " $\frac{1}{4}$ usual amount of phosphoric acid.
4. " " usual amount of phosphoric acid.
5. " " twice usual amount of phosphoric acid

The Botanical Section.

SOME OSTRICH FOOD PLANTS.

By Joseph Burtt-Davy, F.L.S.,
Government Agrostologist and Botanist.

While on a short holiday visit to the Eastern Province of Cape Colony, in July, I availed myself of the opportunity to visit a number of ostrich farms in the Albany, Bathurst, and Cradock Divisions, in order to study the plants which constitute the wild and the artificial foods of the domestic ostrich. My object was to assist the prospective ostrich grower in the Transvaal to select those parts of this Colony in which the most suitable kinds of wild plants occur, and to cultivate the best crops for artificial feeding.

Artificial Feeding.

In regions of winter rainfall, as in parts of the Western Province, the natural veld may produce enough growth at that season to keep a large number of birds without other feed. The chief difficulty under these circumstances is to provide green feed in the dry summers, and this is furnished by irrigated lucerne, an acre carrying five and even seven birds under favourable conditions. Maize and chopped leaves of the American aloe can be added for the sake of variety, to furnish a more evenly "balanced" ration, and to act as a corrective to the succulence of the green lucerne.

Winter Pasturage.

In those parts of the Eastern Province where the Karroo becomes dry during the winter and natural pasturage is scarce, artificial feeding of the birds is then found necessary to the production of good feathers. In the districts where spek-boom is plentiful, as in the Fish River Valley, below 2,500 feet elevation, it is considered an indication that artificial feeding should be resorted to when the birds begin to eat the spek-boom.

At other seasons also, growing chicks and breeding birds are fed on farm crops, in addition to the veld grazing which they find for themselves. Some farmers have fed their birds exclusively on farm crops, but the results have been unsatisfactory.

It is equally important, however, to avoid the other extreme, and not to omit altogether, nor to reduce to too small an amount, the ration of artificial food; Karroo vegetation alone is also found unsatisfactory. It has been clearly demonstrated that it pays to provide an abundance of lucerne, and other crops, at all seasons, especially for growing birds and breeding pairs. Professor Duerden, who is an acknowledged authority on ostriches, states that "A *combination* of lucerne or rape pasturage and natural veld unquestionably gives the best results."

In a normally cold winter lucerne remains dormant, and some other feed must be produced. The principal crops used for this purpose in the Eastern Province are:—Maize, American aloes (*Agave americana*), "leaves" and ripe fruits of the prickly pears (*Opuntia Tuna* and *O. Ficus-indica*), rescue-grass, rape, and winter oats. To these might be added Australian saltbush, vetches (*Vicia sativa, V. villosa,* and *V. fulgens*), mangels, sugar-beets, Swiss chard or spinach-beet, New Zealand spinach, and Hottentot fig or gokum (*Mesembrianthemum edule*). Moistened lucerne hay and lucerne meal can also be used to great advantage.

Lucerne.

Lucerne is the king of ostrich foods, not only on account of the tremendous bulk of forage which it yields on a limited area, but also because it supplies the nitrogenous, muscle-forming material which is deficient in the ordinary Karroo vegetation. An acre of irrigated lucerne is expected to carry from three to seven birds, according to the method of feeding adopted.

A rumour has reached the Transvaal that lucerne produces a poor quality of feather, and I was asked to look into this point. Careful enquiry made among a number of independent growers proved that the rumour was founded on insufficient data. It seems that there is greater mortality among young chicks if fed *exclusively* on lucerne than when they have some natural veld in addition, and some of the leading breeders are adding patches of karroid or thorn-veld to their lucerne camps.

I was not able to visit the Oudtshoorn District, but was informed that there the birds are almost exclusively fed artificially, chiefly on lucerne. Large feathers are produced by this means, but prominent buyers and good judges state that those grown entirely on lucerne lack the "quality" of feathers from birds fed partly on wild Karroo veld. With the enormous increase in the number of birds kept there is a consequent tendency to over-production of common feathers, and this is likely to increase. Under such circumstances only high-grade qualities will command good prices, and to produce these particular attention must be paid to the feeding of the birds. Variety of diet is found to be as necessary for the successful raising of ostriches as for poultry, cattle, horses, and other kinds of live stock.

Eastern Province farmers are rapidly increasing their lucerne areas. At Halesowen, at Heatherton Towers, and elsewhere, all available river-bottom land is being cleared, graded and levelled for lucerne, and wherever possible water is being pumped or led on to the land. At Halesowen there are ninety acres in lucerne. At Heatherton Towers land is being prepared for 150 acres, and a £1,000 pumping plant has been put down to raise water from the Fish River; the land is laid out in checks of 500 yards by 10, equalling one acre each, with a slope of 18 inches in the 500 yards; it takes two hours to irrigate an acre, pumping at the rate of 27,000 gallons per hour; water is applied once a month, i.e. after each cutting, so that the amount of water there required for one crop of lucerne may be calculated at 54,000 gallons per acre. Different soils require different amounts of water; at Irene, in the Transvaal, two irrigations

per month are found necessary, but at Skinner's Court we only use one a month.

Prickly Pears (Opuntia Tuna *and* O. Ficus-indica).

The prickly pear is a useful adjunct to ostrich farms, but its value as a food plant seems to have been somewhat over-estimated. Breeders state that it proves too laxative and not sufficiently nutritious if used alone; the addition of more nutritious foods such as maize corn, and astringents like American aloes, is found necessary. The latter acts as a corrective to the laxative tendency of the prickly pear. Unlike cattle, birds cannot eat the prickly pear "leaves" unless chopped up for them. They can, however, eat the fruit unaided, and where the bush is thick with prickly pear, as in places along the Great Fish River, the birds are turned into it when the fruits are ripe; they are kept out, however, while the fruit is green, as they are very liable to injure their eyes with the fine spines of the unripe fruits.

It is highly desirable that in planting opuntias for stock-feed only the Kaal-blad form (*Opuntia Ficus-indica*) should be used; the true prickly pear (*Opuntia Tuna*) is not only a most troublesome and noxious weed, but is dangerous both to birds and to other live stock. As a weed it has cost some farmers as much as £6 per acre to clear their lands, even when not thickly infested. We have recently introduced into the Transvaal some of Luther Burbank's new "Spineless Cacti" and hope they will prove even more serviceable than the ordinary Kaal-blad. We do not expect, however, to have enough for distribution before they have been propagated for two years.

In planting prickly pear of any variety, it is most desirable that it should be set out systematically, preferably in the form of hedges round kraals or camps, where it can be kept absolutely under control. Whenever it appears sporadically in the open veld or bush, through stray pieces or seeds being carried by stock, game, or baboons, it should be destroyed. If this is done regularly and systematically, as part of the routine work of the farm, it is quite easy and inexpensive to keep the plant under control.

In view of the carelessness and negligence displayed by some farmers, it may be desirable to legislate against the ordinary spiny form, as a noxious weed, allowing only the Kaal-blad forms to be grown for feeding purposes. The latter can be obtained in quantity from farmers near Cradock, Cape Colony.

American Aloe (Agave americana).

The American aloe has long been grown as a hedge-plant in South Africa; it is now found useful as an ostrich food in seasons of drought. As is the case with prickly pear it cannot be pastured by the birds, but must be chopped up for them; two boys with large butcher knives are said to cut up enough for a huudred birds in two hours. The agave is more nutritious than the prickly pear, and can be used without the addition of maize corn; but it contains an astringent juice, and if fed alone proves too constipating; a mixture of prickly pear or other succulent feed acts as a corrective to this tendency; 25 lbs. *per diem* per bird is considered a suitable ration.

The increase in number of ostriches kept is leading to an increase in the quantity of American aloe being planted for ostrich food. Near Grahamstown it has been seriously affected during the last few years with a fungous disease, which has considerably reduced the yield of good leaf.

The common or bitter wild aloe of the Eastern Province (*Aloe ferox*) is said to be useless for feeding purposes, and the allied species of the Transvaal (*A. Marlothii*) is probably no better. These native or "true" aloes contain a bitter resin, which seems to be disliked by the birds.

Rescue-grass (Bromus Willdenowii).

In every stand of lucerne which I examined in the Eastern Province I found this grass, and in some places it seemed to have taken possession of the lucerne stands, threatening to smother them. It makes excellent forage and pasture; and it has the advantage of growing vigorously through the winter, when most needed, disappearing almost entirely in the summer. I saw stands of lucerne, near Cradock, so full of rescue-grass as to appear almost choked by it, but I was informed that the lucerne entirely overpowered the rescue-grass during the summer. This does not apply to other grasses and weeds, however, and it is found as necessary to keep the stands as clean from them as it is with us in the Transvaal.

Everywhere I found ostrich growers recognising the value of rescue-grass for winter feed, and anxious for further information about it; some of them propose to put down pure stands of it on irrigated lands for winter pasturage for the chicks.

Rescue-grass is a native of South America, and on account of its valuable qualities was introduced into Western Texas as a pasture grass many years ago. From Texas it was taken to California and Europe. Australians visiting California found it to be so useful that they took seed of it back with them under the name of California prairie grass. It was introduced into Cape Colony and Natal several years ago, probably from Australia, and has been known there for some time under the name of "winter grass." Until the last few years, however, it has not received any attention from farmers, largely because it was found mostly on irrigated orchard lands: when grown in the shade of trees it becomes rank and sour, and is then disliked by stock of all kinds; when grown in the open it is sweet and greatly appreciated.

About five years ago the Department of Agriculture re-introduced this grass into the Transvaal for winter pasturage, and it is now being taken up by our farmers. It is to be hoped that its value as a winter food for ostriches will lead to its more extensive use.

Winter Oats and Barley.

Winter oats are grown under irrigation for cutting as early summer forage and "hay." During the winter the birds are allowed to graze the plants close; this seems to have a beneficial effect on the subsequent crop of forage or grain inducing the plants to stool out, probably more than they otherwise would.

Some winter barley is also grown, but mainly to cut green during mid-winter for horse-feed. I did not see any being grazed by birds.

Winter Wheat.

Wheat growing is said to have been carried on extensively in the Eastern Province at one time, but in the districts I visited it has been practically abandoned, I was told on account of rust. There seems no reason why "winter wheat" should not be grown as a *winter crop* under irrigation, taking the place of oat forage and also furnishing a good crop of grain for sale. One excuse is that oat-forage is needed for horse-feed; but if the maize stalks were turned into stock-feed, in the form of hay or silage, instead of being left to waste on the fields as at present, where they act as breeding places for the mealie stalk-borer, there would not be need for more than probably one-fourth of the oat-forage now grown, and the balance of the lands could be put into wheat.

Rye.

Rye is also a useful winter crop for irrigated lands. There is some demand for the grain, but it is not as great as the demand for wheat. A heavier yield of spring forage can be obtained from rye than from most of our wheats, barleys, or oats.

Rape.

This plant has given satisfactory results as an irrigated winter crop in the Eastern Province. It has also done well on parts of the Transvaal high veld as a catch crop sown with the late autumn rains. Rape provides a good deal of sweet, succulent feed at a time when most needed, but it seems likely that wheat, oats, barley, or rye, grown under the same conditions, will give as heavy a yield and at the same time prove more valuable, inasmuch as a grain crop can be reaped from them in spring and early summer. Rape can, however, sometimes be used to advantage as a catch crop where the land is afterwards needed for another crop.

Australian Saltbush.

This valuable crop has been tried by one or two Eastern Province farmers with success, but on account of difficulty experienced in propagation it has not yet become a regular crop. Along the Fish River, near Cradock, and in other places, there is an abundance of brak land on which it is difficult to grow lucerne or any crop but barley. Here saltbush could be grown to perfection, and if cut and fed off the brak land it would in time *reduce the amount of brak in the soil* and make it suitable for lucerne.

The native species of saltbush (*Atriplex capensis*) is readily eaten by ostriches, and the Australian species, of which seed can be had more easily, is equally palatable.

Maize Grain.

Maize grain is largely used for ostrich feeding; comparatively little is grown, however, by the ostrich farmers themselves; the climate seems less suited to the maize crop than on the Transvaal high veld, and ostrich farmers think it pays better to buy their grain than to grow it. One farmer told me that his annual maize bill came to £400. At the time of my visit (July) maize was selling at 14s. per muid in Grahamstown. It might pay enterprising Transvaal maize growers to contract with Eastern Province ostrich farmers to supply their grain in truck lots direct from the Transvaal.

Ostriches as Orchard Scavengers.

A fruit grower near Grahamstown, who has 150 acres in fruit trees, uses ostriches as scavengers, turning them into the orchard for about an hour each day. During the season they pick up the fallen and damaged fruit, thus preventing it from becoming a breeding place for insects. At other times of the year the birds help materially to keep down weeds, and also manure the ground. I was informed that they did no damage to the fruit on the trees, perhaps because being only left for a short time each afternoon they had only time to gather up what lay upon the ground.

Climatic Conditions.

Favourable climatic conditions have almost as much to do with the production of good feathers as proper feeding. It is true that the best results cannot be produced without some artificial feeding. It is also true that even with the best feeding equally good results cannot be attained in all parts of South Africa. This is partly due to the difference in the native food-plants of different districts; partly to the fact that in some districts the rainfall is too great, or the soil is too clayey, too much mud being produced, which stains the feathers and reduces their value. This is said to be one reason why birds pastured entirely on irrigated lucerne paddocks do not yield feather of such high quality as those which have some drier land on which to spend part of their time while the lucerne lands are wet.

Some farmers consider that ostriches will not be profitable where the rainfall exceeds 15 inches per annum. It does not follow because ostriches run wild in certain districts that therefore they can be kept artificially, with profit, in the same districts. It should be remembered that domestication and the attendant camping and artificial feeding bring in many factors other than those which dominate the unfettered actions of wild birds.

At the same time we may remember that climatic conditions are not uniform throughout the ostrich belt of Cape Colony. The climate of the Oudtshoorn Division is different from that of the Albany Division, and the latter again from that of the Bathurst Division. It seems to be uniformly true, however, that the best feathers come from the drier parts of the country.

In the Transvaal we have no veld which entirely corresponds to that of the Albany or Cradock Divisions. Some of the same species of pasture and browse plants find their way north to the Bloemhof and Wolmaransstad Districts. Others occur also in the drier portions of the Marico, Rustenburg, Waterberg, and Western Zoutpansberg Districts. From the climatic point of view the vicinity of Pietersburg most nearly approaches that of the Karroo. One Eastern Province ostrich grower who had travelled all through the Western Transvaal examining farms on behalf of a friend who wished to settle there, stated that he considered the Pietersburg neighbourhood was the most promising of all for ostrich farming.

Types of Ostrich Veld.

The veld on which ostriches are successfully raised is not uniform in character throughout the Eastern Province. On the other hand, not all types of veld are equally suitable.

The Coast Bush of the Bathurst Division.

This is a narrow strip of tick-infested coastal plain from 100 to 200 feet above sea level. Owing to the humidity and greater soil moisture it is said not to produce the quality of feather grown in the Karroo country, but a considerable number of birds, and some of good pedigree, are raised here. It is mainly covered with scrub bush, about 12 feet high, composed of a miscellaneous assortment of small trees (schotia, ekebergia, tecomaria, plumbago, rhus, royena, pavetta, sideroxylon, xanthoxylum, grumilea, euphorbia, etc.) which do not yield much feed. Large and sheltered grass-clothed openings occur, however, which form excellent ostrich camps; in addition to several grasses and sedges they produce growths of a native clover (*Trifolium Burchellianum*), Burr-clovers (*Medicago denticulata* and *M. laciniata*), Dubbeltje-doorns (*Emex centropodium*), etc., which furnish pasturage. These keep green, and provide some feed throughout the winter.

Coastal Grass Plain.

Above the coast bush-line is a strip of downs reaching an altitude of 750 feet above sea level at Trapps Valley, mainly covered with grass interspersed with scattered bush and thorns (*Acacia horrida*). Here also some good birds are grown. There is a noticeable tendency for these grass-downs to turn into low thorn-scrub when not kept cleared.

Inland Bush Veld.

In the Albany Division there is much scrubby bush country, where birds can be kept successfully, but a larger acreage is required than on the true Karroo veld.

Karroo Veld.

This, combined with lucerne paddocks, furnishes the ideal ostrich country. It is composed of short bushes ("Kort Karroo") only a few inches high, of such dry composite plants as Goede Karroo-bosje (*Pentzia virgata* and *Pentzia globosa*), Draai-bosje (*Aster filifolius*), Schaap-bosje (*Felicia fascicularis*), and Vaal Karroo (*Phymospermum parvifolium*), with Vyge-bosjes (*Mesembrianthemum* spp.) on certain soils. These plants cover the plateaus and tablelands and furnish the principal feed of both ostriches and sheep and carry the largest number of head of stock of any type of Karroo veld.

Karroid Hillsides.

On the steeper slopes of the hills the Kort Karroo-bosjes are replaced by taller, shrubby vegetation such as Spek-boom (*Portulacaria afra*), Bitter Aloes (*Aloe ferox*), Melk-boom (*Euphorbia grandidens* and *E.* spp.), *Pappea capensis*, etc. Among these the birds secure a certain amount of feed, but very little as compared with that found on the plateaus.

River Bottom-lands.

The rich alluvial river bottoms of the Great Fish River are covered with thorn bush (*Acacia horrida*) and other vegetation such as Aar-bosje (*Walafrida geniculata*), *Lycium austrinum*, *Monechma divaricatum*, and Ganna (*Hermannia pallens*) all of which furnish

good feed in their season. It is found more profitable, however, to clear and level as much of this land on to which water can be led or pumped as is possible, and to lay it down to lucerne.

Some of this alluvial land is very brak, producing halophytic plants, such as the Regte Ganna (*Salsola aphylla*) and Vaal-brak Ganna (*Atriplex capensis*), all of which are eaten by ostriches, together with many useless plants, such as succulent species of Euphorbia and some of Mesembrianthemum.

The Purple Tulp (*Moræa polystachya*) is common, and often causes loss among strange stock, but not among birds.

Homestead Plants.

Around the older homesteads an alien vegetation has asserted itself to the exclusion of most of the original veld, and furnishes a good deal of valuable grazing for domestic stock. This is mainly composed of Kweek-grass (*Cynodon*), among which one usually finds Pepper-cress (*Lepidium capense*), which is a favourite with birds, and such weeds as the Cape-weed or Gouds-bloem (*Arctotis calendulacea*), which is sometimes eaten, *Lasiospermum radiatum* which remains untouched and allowed to seed freely, and Stink-blad (*Datura Tatula*) and Mexican tobacco (*Nicotiana glauca*) both of which sometimes poison young chicks.

NATIVE FOOD-PLANTS OF THE OSTRICH.

It is popularly supposed that the ostrich eats any and everything green. This is not the case, however; close observers soon note that certain plants are favourites, others are eaten only sparingly or in times of scarcity, while many are ignored altogether, and a few are poisonous. The following are the most important which came under my notice:—

1. Goed Karroo-bosje (*Pentzia virgata*).—This is a small grey bush with button-like heads of yellow flowers; it forms the principal vegetation over hundreds of square miles of Karroo in the northern portions of Cape Colony and southern and western parts of what Dr. Bolus terms the "Northern Composite Region" of South Africa. It also occurs, but less extensively, in the south-western districts of the Transvaal, from Wolmaransstad westward, and in the drier parts of Zoutpansberg West. This plant is a great favourite with ostriches and sheep.

2. Draai-bosje (*Aster filifolius*, Vent. [*Diplopappus filifolius*, D.C.]).—This plant has green foliage and blue daisy-like heads of flowers; it is often found mixed with the "Goed Karroo," but generally occurs on stony hillsides and in poorer soils than the latter. It occurs also in the western and northern parts of the Orange River Colony and in the South-Western Transvaal. Said to be a favourite with ostriches.

3. Schaap-bosje (*Felicia fascicularis*).—A low-growing, blue-flowered shrublet of the Composite Karroo, much eaten by stock and considered a valuable feed. Found in the Uitenhage and Albany Divisions, etc., and Kaffraria, extending northward to the south-western districts of the Transvaal.

4. Vaal-Karroo (*Phymospermum parvifolium*).—An abundant and widely distributed composite plant of the Karroo, in poor stony

ground where *Pentzia virgata* does not thrive. It is considered one of the three most useful Karroo bushes for stock.

5. *Vyge*-bosjes (*Mesembrianthemum* spp.).—Many species of this interesting genus, of very varied form, occur in the true Karroo. They produce succulent foliage which contains so much moisture that stock feeding on them are said to care little about daily visits to the water vlei. These succulent plants must form a valuable supplement to the otherwise dry, woody pasturage of the Composite Karroo. *M. floribundum* and *M. obliquum* are said to be the favourite species. Neither of these appears to occur in the Transvaal, but in the S.W. districts we have several others, some of which are likely to be useful.

6. Aar-bosje or Water-finder (*Walafrida geniculata* Rolfe, [*Selago leptostachya*, E. Mey]).—A low, leafy, perennial plant with spikes of small blue or white flowers, found generally on gebrokken veld. By some farmers of the Albany District this is considered the very best of the various native food-plants of the ostrich. Also found in the Divisions of Riversdale, Mossel Bay, Humansdorp, Uitenhage, Victoria East, Queenstown, Prince Albert, Somerset, Richmond, Graaff Reinet, Aberdeen, Hanover, and Colesberg, and in the Orange River Colony. Not reported from the Transvaal.

7. *Monechma divaricatum*.—An undershrub, 2 to 3 feet high, with pink or rose-coloured flowers, formerly common in the Fish River Valley, near Grahamstown, but in places almost eaten out by the birds, so fond are they of it. It is also found near Graaff Reinet, in Little Namaqualand (at the Kaus Mountains, and between Spektakel and Komaggas), and in British Bechuanaland, where it is a favourite food of cattle, affording nourishing winter pasturage, which keeps the stock in excellent condition. I have not yet found it in the Transvaal, but expect it may occur in the Marico District, and perhaps also in the south-west.

8. *Hermannia pallens*.—This is one of the numerous sorts of Ganna-bosje. It is a much-branched, scraggy, very rigid, small bush, with yellow flowers and more or less densely covered with close-pressed, flat, silvery, star-shaped scales. At Heatherton Towers, in the Fish River Valley, near Grahamstown, it is a favourite ostrich food, there considered one of the best. It also occurs in the Caledon and Uitenhage Districts, and probably elsewhere in the Eastern Province. I have not met with it in the Transvaal.

9. *Isoglossa ciliata*.—Table Farm, Grahamstown; said to be a favourite food of the ostrich, but possibly mistaken for another plant.

10. *Galenia spathulata*.—A weed around Grahamstown; said to be eaten occasionally. Not known from the Transvaal.

11. *Lycium austrinum*.—This is a shrub 4 to 6 feet high, mostly spineless, but sometimes producing short spines on the branches; the leaves are in fascicles of five to twenty at the nodes, and about ¾ inch long; flowers lavender coloured, nearly an inch long, with a tubular corolla. At Heatherton Towers it is a favourite ostrich food. It occurs in the Albany, Somerset, Cradock, Graaff Reinet, Knysna, Queenstown, Sutherland, Prince Albert, Murraysburg, and Colesberg Divisions; and is generally found along the river valleys. It does not appear to reach the Transvaal.

12. Vaal-bosch (*Tarchonanthus camphoratus*).—This is a valuable stock food; it is more abundant in the South-Western Transvaal, on

parts of the Springbok Flats, and in parts of the Western Zoutpansberg, than in any part of the Eastern Province that I visited. Generally found on limestone outcrops.

13. Rosyntje-bosch (*Grewia cana*).—Common in our south-western districts, extending into Bechuanaland and the Midlands of Cape Colony. Though I have no actual proof that this is eaten by ostriches, it is almost certain to be; it is a favourite browse plant of buck and stock.

14. Sweet Thorn or Mimosa (*Acacia horrida*).—This form grows along the river bottoms. The seeds and leaves, both green and dry, are said to be greedily eaten by ostriches. The same species of sweet-thorn occurs in our south-western districts, and a slightly different variety in other parts of the Transvaal. Being a leguminose plant it may be expected to be rich in nitrogenous compounds.

15. Spek-boom (*Portulacaria afra*).—This succulent shrub is a favourite food of elephants in the Addo Bush. It is a prominent feature of the vegetation in the drier parts of the Albany, Somerset East, and Bedford Divisions, chiefly below 2,500 feet elevation. I am told that it reaches its northern limit (in the Eastern Province) on the south-east slopes of the Spekboomberg, a few miles north of Cradock. It reappears in the Transvaal at the Spekboom River (at about 4,100 feet alt.), a few miles north of Lydenburg, and again along the Oliphant's River beyond Ohrigstad, but I am not aware of its occurrence elsewhere in the Transvaal.

The spekboom furnishes a certain amount of succulent winter feed for the birds, but I am told that they leave it until other available feed is exhausted. When birds begin to feed on spekboom it is considered time to begin artificial feeding.

In the Albany Division there are said to be two distinct varieties, one with paler foliage and a more drooping habit ot growth, often producing long trailers, which hang down over the rocks; this form is said to be useless for stock feed.

16. Cape Saltbush or Vaal Brak Ganna (*Atriplex capensis*).—This species of saltbush grows in brak river lands in the Midlands, but is not recorded from the Transvaal. It is considered a valuable browse plant for stock, especially in winter.

17. Regte Ganna-bosch or Aasbosje (*Caroxylon aphylla*).—A tall, succulent shrub of brak lands, common along the Fish River at Halesowen, and elsewhere. It occurs on the borders of Saltpans, near Bloemhof, and in the Christiana District of the Transvaal. Said to be a favourite with ostriches.

18. Dubbeltje-doorns (*Emex centropodium*).—This is not the plant known as Dubbeltje-doorns in the Transvaal, and I have not met with it here. It is a somewhat succulent, decumbent species, common in sandy soils along the coast in the Bathurst Division. Ostriches are said to be particularly fond of its young and tender shoots. It becomes an exceedingly troublesome weed when once established in arable land; the burrs are prickly, and when hard and dry are injurious to the bare feet of dogs and Kaffirs.

19. Pepper cress (*Lepidium capense*).—This is a common annual weed round homesteads in the Albany Division, and is a great favourite with birds in winter. It is also a common weed round Transvaal homesteads.

20. Cape-weed or Gouds-bloem (*Arctotis calendulacea*).—This prostrate plant is common as a weed around homesteads and by roadsides, and is said to be occasionally eaten by birds. It lies too flat on the ground, and produces too little accessible foliage to be of much value. I have not yet met with it in the Transvaal, though it is almost sure to reach us sooner or later. In parts of Australia it has become a troublesome weed.

21. Cassia (*Cassia tomentosa*).—A perennial winter-flowering shrub from South America, with golden-yellow flowers, is commonly naturalised near Grahamstown, at Atherstone, etc., and is greedily eaten by ostriches.

22. Bitter Karroo-bosje (*Chrysocoma tenuifolia*).—A low-growing, yellow-flowered Karroo-bosje, with brighter foliage and darker flowers than the Goede Karroo. The foliage is resinous and bitter, and is not much liked by animals; ostriches and other stock sometimes eat it, however, in times of scarcity, but it is said to produce internal disorders if eaten in quantity. It is generally considered to be a veld weed, and is reported as spreading injuriously in some divisions of the Eastern Province, choking out the better species. It is common throughout the Northern Composite Region and is also found in the South-Western Transvaal.

Poisonous Plants.

Mexican Tobacco (*Nicotiana glauca*).—This alien bush is not uncommon, and is widely distributed through the Eastern Province, where it evidently finds the climate congenial. It also occurs spontaneously in the south-western districts of the Transvaal. It is decidedly poisonous to ostriches. Mr. Arthur Douglas reports having recently lost eight chicks from eating it, and Mr. Gray Barber also reports losses from this cause. Cases of poisoning are said to be easily recognised, the birds turning giddy. Doses of strong coffee or chicory root are used with beneficial effect, when the symptoms are noticed in time.

Stink-blad (*Datura Tatula* and *D. Stramonium*) are also said to poison ostriches. Both plants are common round homesteads. They are easily and cheaply destroyed if taken in time and not allowed to scatter seed.

Purple Tulp (*Moraea polystachya*) is abundant in the Albany District, and was in full flower at the time of my visit. It is poisonous to stock, but like Yellow Tulp (*Homeria pallida*) is not eaten by animals that know it. It is said to be avoided by ostriches, and I did not hear of any losses of birds from this cause.

Importance of Selection of Birds.

There is great variation in the class of feather produced by different birds. The best of feeding and the most favourable climate will not produce high-class feathers from birds of poor quality. The power of producing good feathers seems clearly to be an inherited character. The high standard in feathers attained at the present day is due to steady and skilful selection during some 30 years, and the mating together only of wisely selected birds.

Perhaps in no industry is the value of selection more clearly demonstrated than with ostrich farming, although it is perhaps the

youngest of stock industries. Common birds can be bought to-day at £1 a head, but selected, pedigree birds, readily change hands at £250 apiece; while I was in the Albany District one choice bird brought £400, and a record figure of £1,000 a pair has been obtained by Mr. White, of Table Farm. Grandchildren of "Old Jack," of Halesowen (Plate 6), who is perhaps the most famous bird in South Africa, sold last year at £10 apiece, while still young chicks.

Age of Domestic Ostriches.

A profitable feature of ostrich farming is the age to which ostriches live, and continue to produce good feathers, when in captivity. "Old Jack," of Halesowen, has been in the possession of Mr. Hilton Barber for 32 years, and how much older he may be is not known. Mr. Barber bought him from Mr. Heathcote, and he is probably one of several caught by Mr. Heathcote in Khama's Country, whence Mr. Heathcote's original stock came. "Old Jack" cost Mr. Barber £40, and is claimed to have earned no less than £32,000 for his present owner.

THE CITROUS FRUIT-ROT CAUSED BY THE BLUE MOULD, *Penicillium digitatum* (Fr.), Sacc.

By I. B. Pole Evans, B.A., B.Sc., F.L.S.

At the present time the citrous industry of the Transvaal is no unimportant one, and with the improvements in scientific horticulture, advocated and introduced by the Department of Agriculture within the last few years, there is every reason to believe that ere long it will rank foremost amongst the fruit industries of this Colony. This being so, it is our duty to turn our attention to those factors upon which its success or failure may ultimately depend. More often than not failure in such undertakings is due to the appearance and spread of some disease, and the present article is written with the express purpose of warning citrous growers, and especially those who intend exporting these fruits, against a fungous pest which may cause them serious trouble and loss unless they take the necessary precautions.

The fungus is a common mould; it is known botanically as *Penicillium digitatum* (Fr.), Sacc. Such moulds are familiar to most people; they frequently occur on bread, jam, cheese, and other organic matter when it is allowed to remain undisturbed in damp or moist situations. The particular mould under discussion is found almost exclusively on citrous fruits. It first appears on the fruit as a white furry growth, which is preceded by a softening of the affected parts. The white growth spreads rapidly over the fruit, and later on gradually turns an olive green colour from the centre of infection, as is shown in the coloured plates. This mould probably occurs throughout the citrous orchards of South Africa, and is undoubtedly more prevalent in some parts than others. Attention first seems to have been directed to it by Mr. Claude Fuller, Government Entomologist, Natal, for in his annual report for the year ending 31st

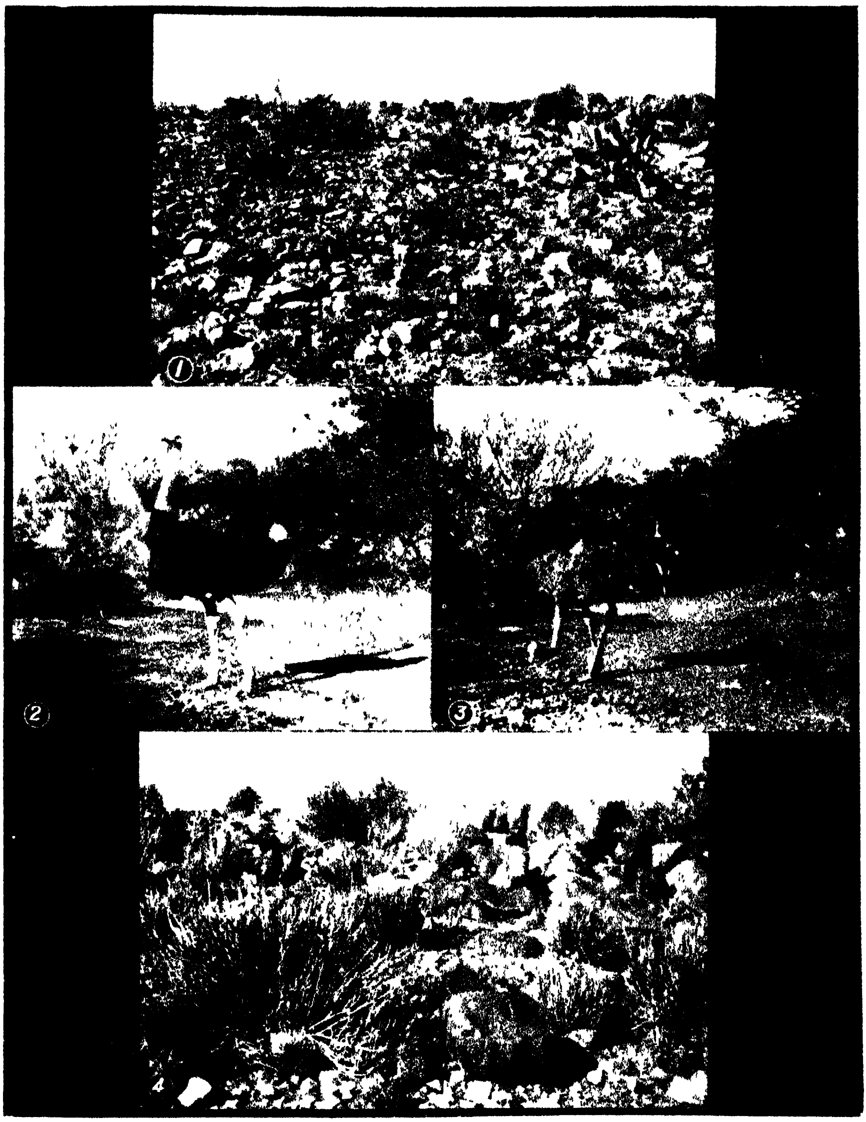
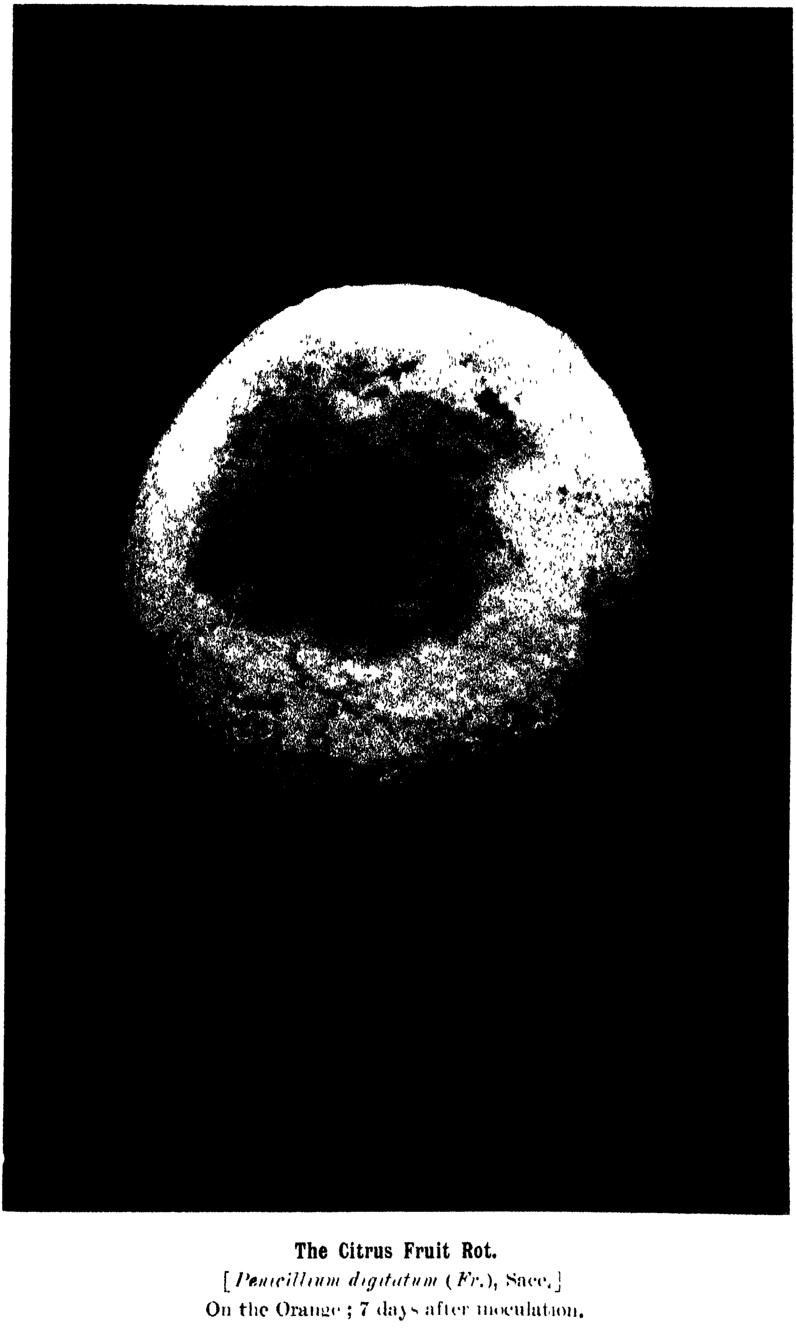


Plate 6

Ostrich Veld in the Eastern Province.

1 and 4 Karroo Veld near Cradock.
2 Old Lock of Halesowen
3 Thornveld at Halesowen



The Citrus Fruit Rot.

[*Penicillium digitatum* (*Fr.*), Sacc.]

On the Orange ; 7 days after inoculation.

December, 1903, he makes the following interesting observations regarding this disease :—

"*Orange mould.*—A considerable amount of damage has been done by mould to the orange crop in the neighbourhood of Pietermaritzburg during the past two autumns. Oranges readily become mouldy whilst hanging upon the trees and drop to the ground in great numbers. Observations go to show that the mould (*Penicillium* sp.) cannot of itself gain an entrance to the fruit, but, given the slightest injury to the rind, it destroys fruit which might otherwise reach sound maturity Many fruits are certainly wounded by several agencies . (1) by thorns or adjacent twigs, (2) by the newly hatched larvae of *Carpocapsa* sp (the Natal codling moth), (3) by the fruit fly, which, in depositing its eggs, perforates the rind (this is not by any means a common agency), and, lastly, by the fruit moth"

This fungus was first collected by the writer on fallen oranges in the northern Transvaal just over three years ago, there and then it was realised that it might become in time a dangerous parasite, and attention was at once drawn to the fact

During the past six months the same fungus has again come before the writer's notice This time much more prominently, as the cause of a rapid decay in nearly all consignments of citrous fruits from Natal, especially on oranges, lemons, naartjes, mandarins, and limes It occurred so constantly and so abundantly in these consignments that it seemed advisable to obtain as much information as possible regarding its nature and pathogenic properties A series of experiments were accordingly carried out with this end in view, the result of which has been to show that the fungus must be regarded as a dangerous pest to our citrous fruit when introduced by way of the slightest abrasion to the healthy skin Fruit in nearly all stages of development invariably exhibited the white growth characteristic of this fungus in from four to six days after inoculation, and after ten to twelve days was covered with the olive-green mould consisting of myriads of spores

Although it has frequently been asserted that this fungus is not an active parasite, the experiments just referred to hardly countenance this view, but more than ever emphasise the fact that its presence in our citrous orchards can no longer be lightly regarded, and since it is the commonest cause of rot to the great citrous industry of California, we have every reason to forewarn our growers regarding it

In a recent *Bulletin issued by the United States Department of Agriculture, observations extending over a period of three years by no less than six experts especially engaged on an investigation of this disease are recorded It is there estimated that the annual loss to Californian citrous growers caused by this fungus ranges from £100,000 to £300,000.

The results of their observations go to show that the fruit which is least handled is least liable to decay, whilst all processes involving rough handling of the fruit caused a marked increase in the amount of decay. The chief mechanical injuries which were found to render the fruit particularly liable to decay were those caused by the clippers in cutting the fruit from the trees, thorn scratches, and bruises produced in the orchards and packing houses. Much of the Californian fruit is brushed and washed to remove the sooty-mould fungus which lives on the so-called "honey-dew" excreted by scale insects. This treatment also was found to increase

* Bulletin No 123, Bureau of Plant Industry, U S. Dept of Agriculture

decay. The outcome of this inquiry into the cause of the heavy losses sustained by the Californian citrous industry through decay is to show that where due precautions are taken in handling the fruit and keeping the orchards free from insect and fungous pests, there the decay caused by the mould-fungus is slight. Mr. Fuller in a recent communication on this subject says that he is of opinion that the rot will be more prevalent in those parts of this country where puncturing insects are most abundant.

In concluding this article we must again urge upon all citrous growers the extreme importance of keeping their orchards in the most sanitary conditions possible. On no account should fallen or discarded fruit be allowed to become mouldy beneath the trees, but should be gathered up and buried deep.

*Now is the time to act, otherwise in the course of time, if this fungus is allowed to flourish in our orchards, it may in the struggle for existence gradually acquire the property of penetrating the thin-skinned varieties of sound fruit. Should this come about, then the mould-fungus will be a far more difficult and dangerous organism to deal with than it is at present.

THE NEW YORK APPLE TREE CANKER OR BLACK ROT FUNGUS IN SOUTH AFRICA.†

By I. B. Pole Evans, B.A., B.Sc., F.L.S., Plant Pathologist.

The object of this note is to call the attention of apple growers in this country to the presence of another imported fungus, and one which it will not be well to neglect. The fungus in question is known to botanists as *Sphaeropsis malorum*, Peck, and is a serious pest in the apple, pear, and quince orchards of North America. I have recently found this fungus on apples from the Grahamstown and Paarl Districts of Cape Colony.‡ The apples were in a rotting and mummified condition. They were consigned to the Transvaal for consumption, and upon arrival here were seized upon and detained by the plant inspectors of the Transvaal Department of Agriculture. During the past three months four hundred and ninety-eight cases of apples and pears in this condition from Cape Colony have been detained, and in order to safeguard the interests of Transvaal fruit-growers, the Government, under Government Notice No. 569, of 18th June, 1908, have warned importers of fruit that all consignments of pomaceous fruits found infected with this fungus to the extent of one per cent and upwards will be destroyed upon arrival in this Colony or returned to the consignor.

There is no reason to suppose that this number by any means represents the total amount of diseased fruit that has reached the Transvaal, to say nothing of the other parts of South Africa. From the above statement

* Since this article was written, the Transvaal Government, under Government Notice 847 of 1908, has prohibited the importation into this Colony of all citrous fruits affected with this fungus.

† A paper read before the meeting of the South African Association for the Advancement of Science, at Grahamstown, Cape Colony, July, 1908.

‡ Since this article was written this fungus has also been found in a consignment of apples from Sydney, Australia.

alone it is clear that this fungus must be doing a certain amount of damage to the apple and pear crops where it is present, and there is further no reason whatever why it should be allowed to extend its range of operations and add to the loss and trouble that we already experience in raising these crops.

On this account, therefore, I propose to give a brief description of this fungus, its geographical distribution, its effect upon the fruit, leaves, limbs and tree itself, as well as the measures which are adopted to check its spread in places where it is most troublesome.

This fungus is a native of North America. It was described and brought to the notice of the public in the year 1879 by Peck, who obtained it on apples from Illinois. Since then it has attracted considerable attention throughout the orchards of the northern and eastern United States, where it is commonly known as the New York apple tree canker, or black rot when it occurs in the fruit. In the eastern States it does considerable damage to the foliage of apple trees.

It seems likely that this fungus has now established itself in Europe, for Salmon* has recently called the attention of apple-growers in England to a leaf-spot disease caused by a Sphaeropsis, which will probably prove to be *Sphaeropsis malorum*, Peck.

Sphaeropsis malorum occurs commonly on the apple, pear, and quince, as well as several other pomaceous plants. It attacks all parts of the tree above ground, producing cankers on the twigs and branches, spots on the leaves, and a black rot of the fruits.

Speaking of the injury caused by this fungus in the State of New York through the cankers alone, Paddock† says :—" The extent of injury done to the orchards of the State can scarcely be estimated, but it is safe to say that this canker is one of the worst diseases with which the orchardist will have to contend since it attacks the tree directly instead of the foliage and fruit, as is the case with the majority of our orchard diseases. The appearance of the cankers is such that their injurious nature may not be apparent to the casual observer until his attention is attracted by the shrivelling of the leaves ; thus the tree may be ruined before it is realised that anything serious is the matter. In one instance the loss of a large acreage of orchard was due to the attacks of the canker fungus, and in a great many orchards it has done serious damage."

Limbs affected with the canker fungus exhibit discoloured and ruptured bark, much as though they were suffering from sun-scorch, but with this marked difference, that instead of the bark peeling off as it generally does with sun-scorch, it remains clinging to the infected limb. Circular pits and scars on the branches are also characteristic evidence of this fungus. The larger limbs are more subject to the disease than the smaller twigs, and it not at all infrequently happens that the fungus encircles the entire limb, thus sooner or later bringing about its ruin. Limbs that suffer from sun-scorch are said to be particularly prone to attacks by the canker fungus, and there is very little doubt that the susceptibility or immunity of certain varieties of trees to sun-scorch determines to a great extent their liability to canker. In fact there is very little doubt that the injuries due to the canker fungus were previously put

* Salmon, E. S. Gard. Chron., 2nd Nov., 1907, pp. 305-306.
† Paddock, W. Bull. 163, N.Y. Agric. Expt. Station, p. 188.

down entirely to sun-scorch. Varieties recorded as being particularly susceptible to the disease are :—

Twenty Ounce,
Baldwin,
Wagener.
Greening,
Ribston,

while the Keiffer pear is also said to be highly susceptible.

On the leaves the fungus produces reddish-brown spots from one-eighth to half an inch across, which may be irregular or circular in outline, with a slightly raised purplish border. These spots frequently run together, and may thus destroy almost the entire leaf. In some portions of the United States the leaves become spotted to such an extent that complete defoliation takes place from six weeks to two months before the leaf-fall naturally occurs.

The fungus causes a decay of the fruit commonly known as black-rot, and is said to be one of the chief causes of the rotting that occurs in market apples. Infected fruit first exhibits a brown decay or rot, which very soon changes to a darker colour, and then becomes studded with minute black pimples—the fruiting bodies of the fungus. If these black pimples are kept under observation, it will be noted that they eventually exude small gelatinous masses of a greyish-white matter ; these on microscopic examination are found to be composed of millions of spores, each of which is capable of spreading the fungus. Diseased fruit is quickly reduced to a mummified condition. Ripe fruit is most generally attacked, although the green fruit even while hanging on the tree is sometimes said to suffer, especially if it has been injured in any way by means of hail or insect puncture. (See Plate 7.)

The fruiting bodies of the fungus occur abundantly on the dead twigs, leaves and fruit, and these are undoubtedly the most common sources from which fresh infections arise year after year. In dealing with this disease, particular attention should therefore be directed to the cleanly upkeep of the orchards. It is recommended that all diseased material be cut out, removed and burned, while all scars and wounds be painted over. Further, the trees should be sprayed at least twice with bordeaux mixture, for damp situations and places where the disease has been severe a third application of bordeaux is recommended. The first application of bordeaux should be applied about ten days after the petals have fallen, while the second and third should follow at intervals of a month.

Just to what extent *Sphaeropsis malorum* is prevalent around Grahamstown or in other parts of the Colony I am at present unable to say, but perhaps this is a matter upon which local observers can throw some light.

POTATO ROT (*NECTRIA SOLANI*, PERS.)

By I. B. Pole Evans, B.A., B.Sc., F.L.S., Plant Pathologist.

Last season large quantities of seed potatoes consigned to the Transvaal from France and Germany were found upon arrival to be affected in the manner shown in Plate 8. In some consignments as much as 47 per cent. of the potatoes were in this diseased condition, and were consequently condemned and destroyed by the Agricultural Department as being unfit for seed purposes.

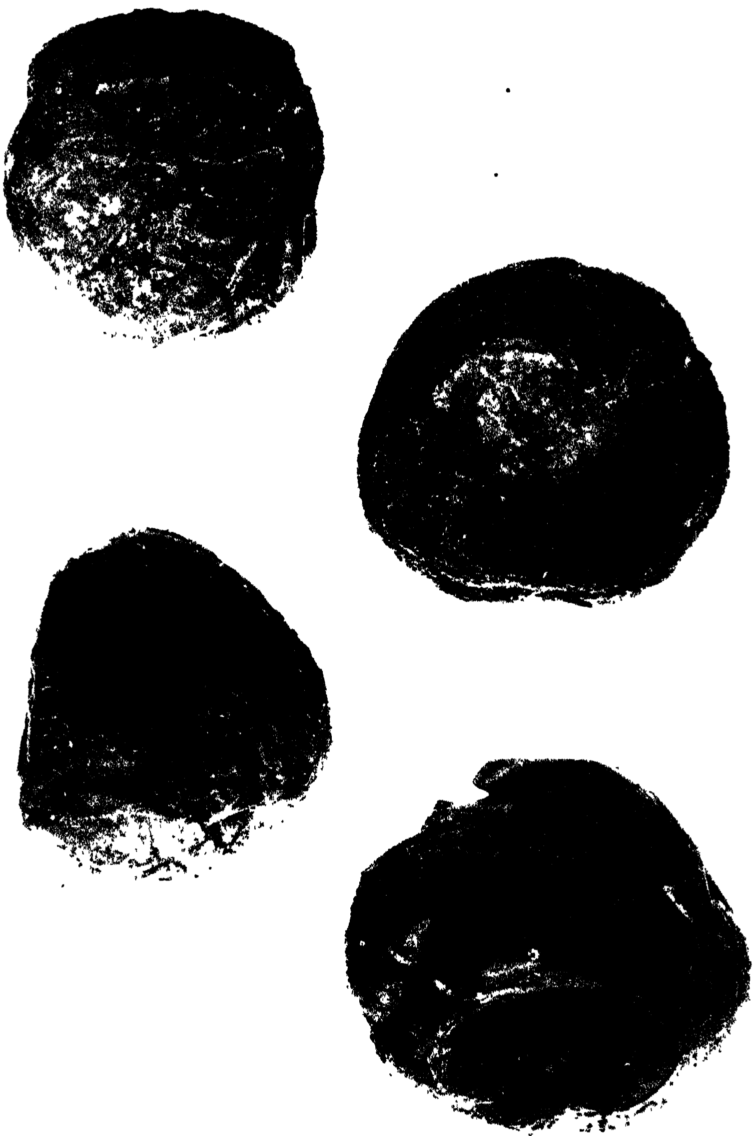


Plate 7

Apples affected with the Black Rot Fungus.

(*Sphaeropsis malorum* Peck.)

Plate 8

Potatoes showing the White Rot Fungus.

(*Nectria solani* Pers.)

The disease in question is brought about by the action of a parasitic fungus which is present in the tubers, and which, when favourable conditions are afforded it, rapidly converts the substance of the tuber into a solid mass of fungous threads, while the potato becomes much shrivelled in appearance. The fungus eventually bursts through the skin of the potato in the form of white slimy tufts, which are the fruiting bodies. As each white tuft is composed of millions of germs or spores, it will readily be understood that the presence of even one diseased tuber is quite sufficient to contaminate its neighbours in the same box or sack, and, in order to safeguard the interests of farmers and potato-growers in this Colony as far as possible, the Government has now issued a warning to the effect that consignments of potatoes found infected with this fungus to the extent of one per cent. and upwards will be destroyed or returned to the consignor.

Experiments which have been carried out at the Botanical Experiment Station, Pretoria, with this disease have shown conclusively that the action of the Government was fully justified in the steps which they took in the matter.

The primary object of the experiments was to observe the resulting crops from seed thus condemned. The potatoes were put in in January. They came on well, and from external appearances gave promise of a good crop. When lifted the tubers appeared quite healthy, but when cooked they frequently had a pink discolouration about them and were "soapy" and disagreeable to the taste.

A microscopical examination of the apparently healthy tubers revealed in nearly every case the presence of the fungus, and on storing a number of the tubers for further observation the characteristic white fungous tufts made their appearance by the end of July, indicating clearly that the entire crop had been infected from the seed which was used.

The trouble is one essentially of stored potatoes, although it has been seen in this country in the freshly lifted crop. The fungus may remain dormant in the tubers for a considerable time until it meets with the conditions favourable for its development. These are moisture, warmth, and exclusion of air. Biting and burrowing insects undoubtedly play an important part in the spread of this disease amongst the tubers.

Planters are advised to take the following precautions with regard to this disease:—

1. To reject all seed which shows evidence of being contaminated with the fungus, or which has come from infected farms.

2. To refrain from planting clean seed in soil which has produced a diseased crop, as the germs are likely to remain in the ground for years.

3. To store the crop in dry, cool, and well ventilated spots.

The application of lime or kainit to infected land is recommended, as both destroy the fungus.

If good lime is available it should be applied at the rate of about two to three tons to the acre, while if kainit is used the dressing should be about 5 cwt. per acre, and should be applied at least two or three months before planting.

FURTHER NOTES ON WINTER PASTURES.

By H. Godfrey Mundy, P.A.S.I.,
Assistant for Field Experiments.

The reports of another year's co-operative experiments have now been received, and in reading these over one cannot fail to be struck by the promising results which have been obtained on the eastern high veld with various winter pasture plants and grasses.

We now have the knowledge and experience which five years of continuous experiments with these grasses, in all parts of the Transvaal, has afforded us, and the object of this article is to put forward a few practical suggestions as to how the information so gained can best be made use of by farmers.

There is a strong desire among stock farmers to establish winter pastures, and enquiries are continually received as to what are the most promising winter grasses to sow.

The suggestions contained in this article apply primarily to the eastern high veld, or, in other words, to that part of the Transvaal lying east of an arbitrary line drawn from Middelburg through Heidelberg to Vereeniging. As is well known, this part of the country is subject to severe frosts in winter, but has the benefit of a more bountiful rainfall in summer than most of the rest of the Transvaal: while, in addition, in many parts, heavy mists are of almost daily occurrence during several months of the winter. These two factors undoubtedly assist "introduced" pasture plants and grasses to better withstand the rigorous winter climate, with the result that our experiments in these districts have been more conclusively satisfactory than elsewhere.

Articles, reports on experiments, and a few letters dealing with winter pasture experiments have, from time to time, appeared in the *Journal*, and, so lately as the last number—July, 1908—we had the interesting report sent in by Mr. Dundas Hamilton, of Lake Chrissie.

The following is a short extract from a letter received from Mr. George Lewis, farming near Belfast, one of the highest and most exposed spots in the whole Transvaal:—"Cocksfoot and Yorkshire fog are still quite green, the enclosed specimen I gathered to-day, 1st of July. The seed was received in 1905, and I have never reported on them before as the experiments would not have been conclusive. This is their fourth winter. Both grasses give big stools, stand the winter well, and make excellent grazing. The same remarks apply to Burnet. As you will see, only the tips of the grasses are touched by frost. Paspalum is doing splendidly—I have a field of 2 acres, *not fenced*, sown last November. I have great difficulty in keeping my horses and stud rams off it. A small test of paspalum sown the year before gave me a splendid cut of hay 3 feet high, and went into winter 18 inches high; this is still standing, the tops quite brown but the undergrowth as green as ever."

Numerous reports to the same effect are now being received continually, and it is surely worth a determined effort on the part of individual farmers to see whether a few acres of such winter pasturage cannot be established on each farm. Co-operative experiments in this direction have now served their turn; they have

clearly shown that, on a small scale, certain grasses can be successfully established, that they will withstand frost, and often even continue to grow for a large part of the winter. If this can be done with small experimental plots surely it can also be achieved on a larger scale provided proper attention and forethought are given to the problem.

The laying down of large areas of grass land must necessarily be an expensive undertaking, and it is only by doing a little each year that the farmer of moderate means can hope for success. What is to prevent every stock farmer on the eastern high veld making a small beginning this season by laying down anything from one to five acres? The cost will not be great, even in the event of failure, and it it should prove successful how great a difference it will mean to the stock-carrying capacity of the high veld farm. Roughly speaking, the cost ot seed will be about 30s. to 40s. per acre, and, in addition to this, there is the cost of fencing, supposing a suitable "camp" is not already available for the purpose.

If good stands ot grass land are to be established and maintained, *the paddocks must be fenced*, in order that the young plants may be protected from the depredations of stock until such a time as they are well and deeply rooted. Further, the grazing of stock can then be regulated during winter, and each paddock can be allowed a certain resting period in order to make new growth before stock are again turned in.

Paspalum is proving itself an entire success in the Transvaal, and is equally valuable for the high veld as for the warmer districts; true it is not entirely trost-resisting, but it is one of the first grasses to commence growth in spring, and, moreover, since it is a very luxuriant grower and partially frost-resisting, it is evidently the ideal pasture for late autumn grazing. Here, then, we have a grass affording first-rate late summer and autumn feed, and then again coming on as the first pasture for spring grazing.

Where dry-land Lucerne can be grown it is probable that this will prove a useful addition to paspalum, since after the natural veld grasses have become unpalatable, the lucerne should be still green and growing. Stock might, therefore, first be kept upon the lucerne, and when this was eaten down, they could be drafted on to the paspalum.

We then come to winter, and must look around to see what grasses we can rely upon to give us mid-winter feed for our stock. From the reports which we have already quoted, this does not seem a difficult matter. Mr. Lewis finds cocksfoot, Yorkshire fog, and burnet answer the purpose well. Mr. Dundas Hamilton also pins his faith to cocksfoot, and, in addition, to Chewing's fescue, cow-grass clover, and white clover. Mr. W. Guthrie, of Standerton, is well satisfied with the frost-resisting powers of tall fescue and rescue-grass (see *Agricultural Journal*, Vol. VI, No. 21, page 75), while other experimenters are equally pleased with red fescue, meadow fescue and timothy-grass. With this weight of evidence before them, are not farmers justified in trying these grasses on a larger scale than is at present attempted? If successful stands can be obtained, and, further, if these are separated into fenced paddocks of convenient size, then it would seem we may have a succession of good grazing from the end of March to the end of August. It would

not be necessary to run stock continually on such pastures; the difference would be very marked if they were allowed on for only a couple of hours a day, and it is needless here to dilate further on the numerous advantages which such a system will present to the mind of the stock farmer.

It is not proposed here to go into particulars of the best methods of laying down grass land. Full and clear instructions were given by Mr. Baylis, late of this Division, in the *Agricultural Journal*, Vol. V, No. 18 (January, 1907), "The Making of Pastures." The methods there laid down are, in parts, somewhat elaborate, but too much emphasis cannot be laid upon the need for *proper preparation of the soil*. Two or three-year-old land is recommended, and it is essential that it should be clean land; this can often be obtained by previously using smother-crops, such as teff-grass or oats which, if sown sufficiently thick, should crowd out the weeds and so clean the land for the following crop. Soils which are naturally of a rather moist character will usually give the best results, but they should not be subject to flooding during summer; with paspalum this may not matter, but with the other grasses, excessively water-logged soil is likely to prove harmful.

Seed of all the grasses and pasture plants here named can now be obtained from seed merchants in South Africa, some of whom advertise in this *Journal*. The usual sowing for most varieties is about 30-35 lbs. of seed per acre, but the clovers will run somewhat lighter than this, and, for paspalum, 15 lbs. is sufficient. Paspalum appears to be proving successful wherever tried in the Transvaal, and if some farmers are doubtful of the finer grasses they might at least make a start with paspalum.

One swallow does not make a summer, neither do a few scattered experiments prove the success or failure of a venture; but unless each farmer takes up the question and sets himself to successfully establish a small initial paddock of winter pasture, we may continue to carry on co-operative experiments indefinitely, and the movement, as a whole, will make no real progress.

BOTANICAL NOTES.

By J. Burtt-Davy, F.L.S., Government Botanist.

Drilled *versus* Broadcast Lucerne.

A correspondent in the Zoutpansberg writes that he has found it necessary to plough up his broadcast stand of lucerne as it is hopelessly swamped with weeds. But he sees no reason why it should not do very well there if carefully sown in drills. He is now going to adopt this method of treatment.

* * * *

Yields of Maize.

Messrs. Reynolds Brothers, of Vaal Station, Standerton District, report having thrashed 570 muids of yellow horsetooth maize from 40 acres, or nearly 15 muids per acre. This crop was grown after potatoes, which had been fertilised with artificial manure. But for the long and persistent drought the crop would probably have returned 18 to 20 muids per acre.

The American Maize Crop of 1907.

The final official estimate of the American maize crop of 1907, is 2,592,320,000 bushels. Although this is fully 335,000,000 bushels less than the yield of 1906, which formed a record crop, it has been exceeded only in that year and in 1905. There is consequently an ample quantity for export, and the amount shipped will probably be quite as great as would be the case if the crop were considerably larger. This is due to the fact that, with a record crop, prices tend to drop, and growers prefer to feed the corn to stock instead of selling. At present prices, however, it would be more profitable to place on the market. As a rule, about one-thirtieth part of the maize crop of the United States is exported.—*The Agricultural News* (West Indies).

Calabash Pipe Gourds.

The best soil for growing the calabash is the dry sandy soil of the Cape Karroo, the poorer the soil the better the calabash for pipe growing purposes, as too rich a soil engenders a calabash too large for this trade; also great care must be taken in cultivating the growth of the gourd to obtain the correct bend in the neck of it, and the Cape farmers, in the heat of the day, i.e. 12 o'clock or about that time, have the calabashes trained to the desired bend. This must be done gradually, as too great a strain is liable to break it, so each day the crop is gone through. Another important point is that after the calabash is cut the tops have to be boiled, and what is most important is that they must be thoroughly dried in the sun, otherwise they are liable to rot.

A Johannesburg manufacturer writes that he expended on this article £1,550 this past season, and should the demand in England be as great this season he will be in a position to buy big quantities, and will buy all he can in the Transvaal before looking elsewhere.

Durum and Hard Wheats.

A practical miller in a large way of business writes:—Although Durum wheats are hard wheats, as far as texture is concerned, we cannot put them in the same category with "hard wheats" as generally described. Hard wheats, as spoken of in the trade as "hard," are those which contain *strength*. The term "strength," in wheat, is used by millers only to denote the power of the dough to retain the gases formed during the fermentation process.

It does not always follow that "hard" wheats do not make such white flour as the strong wheats. There are plenty of wheats which are hard, or strong, which make much whiter flour than some of the softer wheats. Durum wheats, when mixed with soft wheats, do not improve the resulting mixture in any possible way, and they have no effect (except a detrimental one) on the strength. Most soft wheats are stronger, from a trade point of view, than any Durum.

The special value of Durum wheat is in the manufacture of maccaroni.

New Weed Pests.

Mr. S. J. Hyde, of Uitkyk, Leeuwdoorns, Wolmaransstad, sends a specimen of a new weed which has appeared on his farm. Botanical examination proves it to be an American species, which is there known as "hairy stickseed," or botanically as *Lappula texana* (Scheele) Britton. It is widely distributed through North America, in dry soils, ranging from Manitoba and the North-Western Territory to British Columbia and south to Nebraska, Texas, and Arizona. It produces small nutlets ("seeds") bearing short, strong, barbed prickles; when ripe and dry these nutlets separate as small burrs, which stick to the hair or wool of animals, and are thus carried about from place to place; they may become injurious to wool and mohair. The plant is a small slender annual, which occasionally assumes a weed-like tendency in Western Nevada and Eastern California, but though so common and widespread it does not appear to have ever become a dangerous weed in America.

Para-grass (*Panicum muticum*).

Information was recently received to the effect that the so-called African wonder-grass or Angola-grass (*Panicum spectabile*) was being grown with success in Queensland. The Department therefore applied to the Department of Agriculture and Stock, Brisbane, for data as to growth, etc., and for seed.

In reply the Department writes:—*Panicum spectabile* is not at present growing in Queensland, although it has been largely advertised lately. Specimens of the so-called *Panicum spectabile* have, however, when examined at this office, always turned out to be *Panicum muticum*.

Panicum muticum is known in cultivation as "*Para-grass.*" It is described by Scribner as follows:—A rather coarse, reed-like perennial, 4 feet to 6 feet high, with hairy nodes, and narrow, lax panicles, 6 inches to 8 inches long. It is cultivated in South America, and in the West Indies and Mexico, and has been introduced into some of the Gulf States. It is grown with success on the high pine ridges of Florida, and wherever cultivated it is most highly esteemed and regarded as a very fattening pasture grass. How far to the north this grass may be grown successfully does not appear to have been determined, but it is hardy at the Cape of Good Hope and other far extra tropical regions (Baron von Mueller). It is propagated either by seeds or root cuttings.

According to Scribner, this is the same grass described by Grisebach in the "Flora of the British West Indian Islands," under the name of *Panicum molle*, but Scribner considers that the *P. molle* of Swartz is a different species. According to Grisebach, this grass is naturalised in Jamaica, where it is considered "an excellent pasture grass."

Para-grass has been under cultivation in the Botanic Gardens, Rockhampton, Queensland, and the Curator of the Gardens states:—A good many people are under the impression that it is capable of resisting drought, but that is a mistake, as it prefers, and indeed will only flourish, in localities where it has abundant moisture.

We are indebted to the Department of Agriculture and Stock, Brisbane, for seed of this grass, which will be carefully tested at the Botanical Experiment Station, Skinner's Court, Pretoria.

* * * *

Eradication of Prickly Pear.

A comprehensive trial of various preparations recommended in Cape Colony for the extirpation of prickly pear, was carried out last year by the Cape Department of Agriculture. These are reported upon by Dr. E. A. Nobbs in the Cape *Agricultural Journal* for December, 1907. The following is a summary of the report:—

Arsenite of soda in a 1.1 per cent. solution has proved the most effective and economical preparation. Grubbing up the trees and spraying the heaps with this solution, which is the customary method, requires comparatively little arsenite of soda—the least, indeed, of the thoroughly effective processes. This is, however, in practice, probably the most costly of the methods tried, on account of the laborious nature of the operation, and is only to be recommended in the case of clearing land for arable purposes where the grubbing up of the roots is a necessary part of the work in any case. Good grazing land infested with pear may with advantage be cleared by the simpler method of felling the trees, spraying the heaps, and injecting about one to one and a half tablespoonful of a 10 per cent. solution of arsenite of soda (1 lb. to a gallon of water) into the butts of the stumps projecting above the ground. These experiments have clearly shown the efficacy and economy of this method, which deserves to be applied more largely than has been the case in the past. Indeed this process has been little, if at all, used, and has much to recommend it, for, besides cheapness, it is simple and rapid, and the veld is not broken up. With the destruction of the overshading and soil-robbing prickly pears, the natural herbage soon establishes itself on the cleared land. The process of spraying standing trees with a 5 per cent. solution of arsenite of soda (1 lb. in 2 gallons of water), though not as efficacious as the abovementioned methods, may yet be recommended for use in checking the progress of the prickly pear on steep hillsides and on krantzes where more thorough work is impracticable, but where extirpation is very desirable, as it is from such situations that the pest most readily spreads to fertile ground below. The spray will reach trees quite inaccessible to the spade or axe. The drawback to this process, not fatal but serious, is the difficulty of the water supply.

As the outcome of the experiments it is obvious that with even the cheapest known preparations used in the cheapest manner the cost of the operation may at times be greater than the value of the land when cleared. The most costly eradication would be amongst krantzes, precisely the worst sources of infection. The experiments have brought to light no talisman for extirpating prickly pear, but have clearly demonstrated the superior efficacy and cheapness of arsenite of soda.

* * * *

Witch-weed (*Striga lutea*).

"With reference to yours of the 10th June, about sunflower seed received from you in December, 1907. I have had no success with this on account of the severe drought; I wanted this seed to combat the mealie pest, namely the "Brandboschjes." I was told to do this by other farmers. I ploughed the land and sowed the mealies and sunflower (seed) in rows, one each of each alternately, without

irrigation. I have selected dry lands and those where there were most brandboschjes in order to see the effect. The mealie comes up much sooner than the sunflower, and dries up much sooner too; also the brandboschje was three parts less than last year. Half of the sunflower seed did not come up, which I attribute to the drought; if all the seed had come up there would have been less brandboschjes. Speaking generally, I have not won anything from the land, viz., mealies. I got two buckets sunflowers; a few heads were 8 inches broad, but many of the pits were dull because of the drought. In a good season and with half as much more rain it will be a success, i.e. the use of sunflower against brandboschje, because I am sure that my mealies did not die off from this but on account of the drought. Last year we had more rain by about half, and the same land did not produce anything, and at that time the boschjes were growing very plentiful in some places, while this year one is to be seen here and there.

Formerly I experienced that the brandboschje is killed by much irrigation, and the drier the year the better it grows. In my childhood days when much rain fell the boschje was unknown as a pest, and first made its appearance in a warm and dry region; I hope to get more experience next year and a good result.

On the high veld last year my brother also sowed a large piece of land with sunflowers, where no mealies would grow because of the boschje, consequently not one boschje was to be seen, and on the ground next to it there were mealies which was full of the boschje. I am sending you 15 lbs. sunflower seed, and I hope later on to personally make the acquaintance of the Department.—A. P. MEYER, Roodekopjes, 15th June, 1908.

* * * *

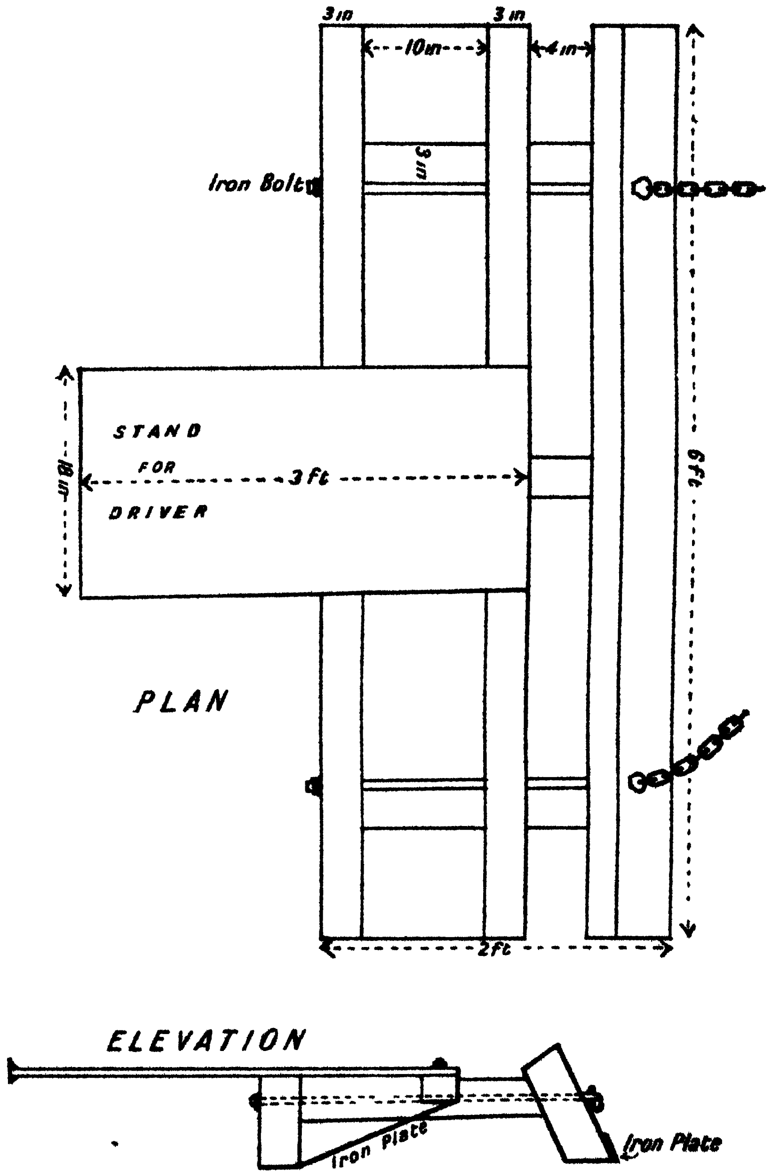
GUAYULE RUBBER.

Enquiries have been received by this Division as to the value of and suitability to this climate of the Guayule rubber-plant. This is an herbaceous Composite, *Parthenium argentatum*, a native of Mexico. It is a plant of very slow growth, and contains little rubber until about eight years old, while ten years may be considered necessary for a crop to become fit for profitable working. Recent advices from Mexico announce that the wild supply is becoming exhausted, while profitable cultivation as a crop is found impracticable, owing to the slowness of growth.

* * * *

The Leveller (Plate 9) may be made of any convenient length up to 12 feet; the steel smoothing plate is very light, about 20 gauge, but will last a long time. It is brought from the middle 3 in. by 2 in. beam to the underneath of the back 6 in. by 3 in. beam, and holes are cut in it for the ties and the bolts; it is a flat steel sheet with ends turned 1 inch and secured with 1 inch screws. The cutter is shod with 2½ inch by ¼ inch steel plate with bevelled edge secured with 2 inch screws; the stand for the driver is of Oregon pine 2 feet 9 inches by 1 foot 6 inches by 1½ inches. In use the driver standing on the plate by moving forward causes the front beam with its cutting edge to enter the ground and carry forward any soil cut off; by moving backward he raises the cutting edge, allowing the accumulated earth to pass under in as great or as little quantity as he pleases, while the sloping steel sheet smooths it out, crushes the lumps, and spreads it into any depressions.

Plan of Ground Leveller used at Skinner's Court.



A cheap and effective implement in use at the Botanical Experiment Station, Pretoria, for levelling uneven ground to be irrigated.

The Entomological Section.

A NOTE ON THE FUMIGATION OF CITRUS TREES WITH HYDROCYANIC ACID GAS.

BY F. THOMSEN, Division of Entomology.

THE frame tents shown in the accompanying photograph (Plate No. 10) were made as recommended in the article on fumigation of citrus trees in the *Agricultural Journal* of 1st April, 1907. These tents are in use at the Government Estate, Tzaneen.

The size and structure of the frames can easily be recognised in the photograph, and any handy man can make them. Flooring boards ripped down the middle will be found strong enough; cut the pieces in the required length, and nail them together: cross-stays are necessary in the larger sizes. Cover the structure with canvas, or in the smaller tents unbleached calico, well oiled, or painted with any kind of paint, will do. A strip of the cloth about 12 inches wide should be left lapping over round the bottom of the frame to allow for earth to be thrown on, so as to stop any leakage of the gas on uneven ground; it would also be advisable to nail a piece of fine mesh wire netting inside the top, as the sharp thorns of the larger top branches would otherwise wear the cloth out too soon; fasten two narrow planks across the two sides; this facilitates the handling of the tents. These light structures must be well secured in strong wind, and should not be left about the garden, besides, fumigation during windy nights is valueless. Very often citrus trees with wide overhanging branches will be found difficult to handle; in this case I would recommend to have the branches pulled together carefully by means of a rope wound round the tree till the tent slips over easily; otherwise the work is done as described in abovementioned article. These frame tents will be found very convenient in orchards where trees are not much above 10 feet high.

I give hereunder a table of quantities to be used in frame tents of various sizes.

Width	Breadth	Height	Water	Sulphuric Acid	Cyanide of Potassium	Cubic Content
ft.	ft.	[illegible]	fl. oz.	fl. oz.	[illegible]	c. ft.
[illegible]	[illegible]	4	1	[illegible]	[illegible]	[illegible]
3	[illegible]	5	2	[illegible]	[illegible]	[illegible]
4	4	[illegible]	[illegible]	1	[illegible]	80
4	4	[illegible]	[illegible]	1	1	96
5	[illegible]	6	5	[illegible]	[illegible]	150
[illegible]	5	7	5	[illegible]	[illegible]	175
5	5	8	[illegible]	1½	[illegible]	200
5	5	9	6	[illegible]	[illegible]	225
5	5	10	6	2	2	250

Plate 10.

Frame Tents for Fumigation of Citrus Trees.

LOCUST DESTRUCTION WORK IN THE TRANSVAAL.

By David Gunn, Division of Entomology.

Since the publication of the report upon the work which was conducted against the brown and red locusts during the season 1906-07, which appeared in the July, 1907, number of the *Agricultural Journal*, no official report has been published regarding the recent campaigns against the brown and red locusts; and although the publication of a few facts in connection with the magnitude of the recent work may, perhaps, be considered by many people as being rather ancient history, there are, nevertheless, others, apart from our farming community, who may be interested in this very important question.

The Brown Locust.—Season 1907-08.

Voetgangers were practically as numerous during the last season as they were in the previous year, but on account of our more perfect organisation and wider experience our work against them was more successful. The principal points which have to be considered in important work of this nature is organisation and administration. It is considered essential to mention this here, on account of the fact that there are many people who still adhere to the opinion that the principal feature in connection with this work is simply to instruct a few locust officers to proceed to the infested areas in order to kill the voetgangers, and allow the matter to rest at that point. It must, however, be taken into consideration that the time which elapses between the hatching of the voetgangers from the eggs and the time when they obtain wings is, approximately, from six to eight weeks, and, therefore, if the work of destruction is to be carried out in a complete and systematic manner, it has necessarily to be performed as expeditiously as possible. This point cannot be too strongly emphasised, because our great success was attributable to this fact.

As in the previous year, flying locusts began to invade the Transvaal much earlier than in former years; that is, they came up from the Kalahari, crossing our borders in the south-western parts, from the Orange River Colony, Cape Colony, and Bechuanaland Protectorate. These took a general north-easterly direction over the Transvaal, many finally proceeding northward into Rhodesia and into Portuguese territory. On the 11th of March the first winged locusts crossed the Orange River Colony border, near the Hoopstad District, and by the 5th of April they had covered nearly the whole of the Transvaal. Thirteen districts were invaded by these flying brown locusts, and three only partially. One of these swarms was fully fifteen miles across its front, and took nearly three days to pass a certain point.

In order to ascertain as fully as possible the amount of damage which was occasioned by these flying brown locusts, we endeavoured to obtain an estimate of the value of the crops destroyed. These statistics were collected by the resident magistrates, who rendered valuable assistance in connection with this compilation. The amount given below does not, however, include the amount of the damage done to the veld, so that the approximate value must have amounted to nearly one million pounds sterling:—

Barberton	£8,283
Bethal (no report)	——
Heidelberg	77,007
Lichtenburg	33,000
Lydenburg	6,700
Marico	33,741
Middelburg	7,598
Pretoria	155,840
Potchefstroom	219,421
Rustenburg (no report)	——
Standerton (no report)	——
Wakkerstroom	1,315
Waterberg	21,410
Witwatersrand	73,345
Zoutpansberg	4,200
Total	£641,860

Oviposition began in June, but did not become general until July. The greatest number of eggs were laid in the southern districts, between June and August, and in the northern between July and September.

As previously stated, our success in the destruction of the voetgangers was principally due to our organisation and administration. A large supply of arsenite of soda, sugar, water drums, an additional supply of spray pumps, and other necessary accessories, was ordered some time in advance of the commencement of the campaign, and an adequate supply of such material was despatched to a central place in each district in order to be fully prepared for all emergencies. Our district locust officers were also appointed about three weeks previous to the commencement of the first heavy rains, so that they had an opportunity of making themselves acquainted with the egg-laying areas in their respective districts, and also of obtaining the names of suitable men to act in the capacity of assistants. By these means we were enabled to perform the work of destruction much more cheaply than would otherwise have been the case.

The following tabulated statement gives the number of swarms which were destroyed between 1st October, 1907, and 15th January, 1908:—

District.	Number of swarms destroyed by officers and locust birds.	Number of swarms destroyed by farmers and natives.
Bethal and Ermelo	65	—
Lichtenburg	162	300
Heidelberg	20	90
Lydenburg	37	—
Marico	527	100
Middelburg	113	50
Pretoria	460	120
Potchefstroom	278	227
Rustenburg	698	—
Standerton	50	—
Waterberg	2,500	300
Wolmaransstad	63	288
Zoutpansberg	1,473	366
	6,446	1,841

Total number of swarms destroyed, 8,287.

Although the sum of £10,000 was originally voted for the work of locust destruction, it was found towards the end of the campaign that this amount was inadequate to carry out the two campaigns. In order, therefore, to bring the work to a successful conclusion, a further sum of £5,000 was voted. The sum of £8,312 12s. 9d. was expended in salaries, transport, and sundries, and the cost of the material amounted to £1,427 1s. 1d., so that the total expenditure in connection with this campaign came to £9,739 13s. 10d. There was, therefore, a fairly substantial balance available for the campaign against the red locusts, which commenced almost immediately after the termination of the work against the brown locusts.

Plate No. 11 shows the areas which were infested by voetgangers during season 1907-08.

THE RED LOCUST.—SEASON 1907-08.

Flying locusts began to invade the Transvaal early in August, and continued throughout September and October. The reports which were received by us indicated that these locusts came from Portuguese territory, Swaziland, Natal, and Zululand. The damage to crops which was caused by these flying locusts may, however, be considered as infinitesimal.

Oviposition commenced in November and continued throughout December. Considerable difficulty was experienced in locating the areas where eggs had been laid, especially in Zoutpansberg District, principally on account of the fact that oviposition took place in uninhabited places in the bushveld, and consequently the transporting

of locust destruction material to these areas proved to be an extremely difficult matter.

The eggs commenced to hatch in the latter end of December in Barberton District, and in the other districts it continued throughout January and into February. Voetgangers appeared in the following districts:—Piet Retief, Carolina, Barberton, Pretoria, Waterberg, and Zoutpansberg.

Previous to the appearance of the voetgangers arrangements had been made in connection with the engaging of reliable and trained men to carry out the work of destruction, and after taking into account the feverish nature of many areas of the low bushveld of Zoutpansberg and Barberton, the almost inaccessible places in which the voetgangers appeared in these districts, and the difficulties which were encountered in the transporting of stores, we must congratulate ourselves upon the success which we obtained.

I shall enumerate the various districts separately in discussing the work of the season.

Zoutpansberg District.

The principal areas of infestation were near Duivels Kloof, to the east of Pietersburg, and to the north-west of Louis Trichardt, in the region of the Zoutpansberg Mountain. It appears, however, that these voetgangers which appeared at the back of Zoutpansberg Mountain were not voetgangers of the red locust, but of the brown. No rains had previously fallen during the season, and the eggs had remained in the ground until the beginning of January. Two sub-district locust officers were therefore appointed, with five assistants each: one having his headquarters at Louis Trichardt and the other at Duivels Kloof, and the work which was accomplished by these men was very thoroughly done. As both centres are more or less of a feverish nature, several of the assistants contracted fever during the campaign, and it became necessary to secure the services of other men to perform their duties during their illness. On account of the intermittent nature of the rainfall, water had to be transported on numerous occasions for a distance of over twenty miles, which, naturally, greatly retarded the work of destruction; but, despite this serious drawback, the campaign was brought to a successful conclusion. It is gratifying to have to state that we received great assistance from the native chiefs in the northern part of the district.

Barberton District.

The infestation in this district was extremely heavy. A few swarms appeared in the De Kaap Valley, but the largest area of infestation was in the vicinity of Komatipoort, Hectorspruit, and Nelspruit. A district locust officer and three assistants were appointed, and the work continued for nearly two months. With the exception of a small field of mealies near Nelspruit, no other crops were destroyed by voetgangers. The work, however, was greatly retarded on account of the extreme drought, which made it exceedingly difficult to secure water for spraying purposes, and thus making it necessary to resort to burning the grass in many cases. The low

veld of Barberton was so very dry at the beginning of the campaign that it was almost impossible to burn grass in order to destroy the voetgangers; but this great drawback was successfully overcome, and the campaign was brought to a very successful conclusion.

Carolina District.

A very slight infestation occurred in this district, in the extreme eastern portion, along the border of Barberton District. These voetgangers were destroyed by natives.

Pretoria and Waterberg Districts.

As the area of infestation in Waterberg District was only a narrow strip along the northern boundary of Pretoria District, we decided, in order to save expenditure, to work the two districts as one. The infestation occurred in Pretoria District from Waterberg, for a short distance south of Pienaars River Station. There were also a few swarms of voetgangers in the neighbourhood of Silverton, and also to the south-west of Pretoria, just beyond the Military Cantonments. On account of the slight infestation in these two latter places, however, the work was performed by the farmers, to whom we issued the necessary material. For the rest of the district, one locust officer and one assistant were appointed. Nineteen farms were infested in this area, and the work was carried out in a most thorough manner. It is pleasing to have to acknowledge the valuable assistance and hearty co-operation which we received from the farmers in this district.

Piet Retief District.

We were of the opinion that this district would be largely infested with locusts, and we consequently despatched a quantity of material to Piet Retief, and engaged a locust officer for the district. Upon investigation, however, we discovered that voetgangers were only appearing on three or four farms in the extreme eastern point of the district

The following statement gives the number of swarms which were destroyed:—

District	Number of swarms destroyed.
Zoutpansberg	4,776
Pretoria and Waterberg	354
Barberton	793
Total	5,923

Plate No. 12 shows the areas which were infested by voetgangers of the red locust during season 1907-08.

The following is a tabulated statement of the cost of the work against the red locust, and also a combined summary of the cost of the locust destruction work for the whole of the season, together with full particulars regarding the quantity of material used, and also the quantity of material on hand at the termination of the work.

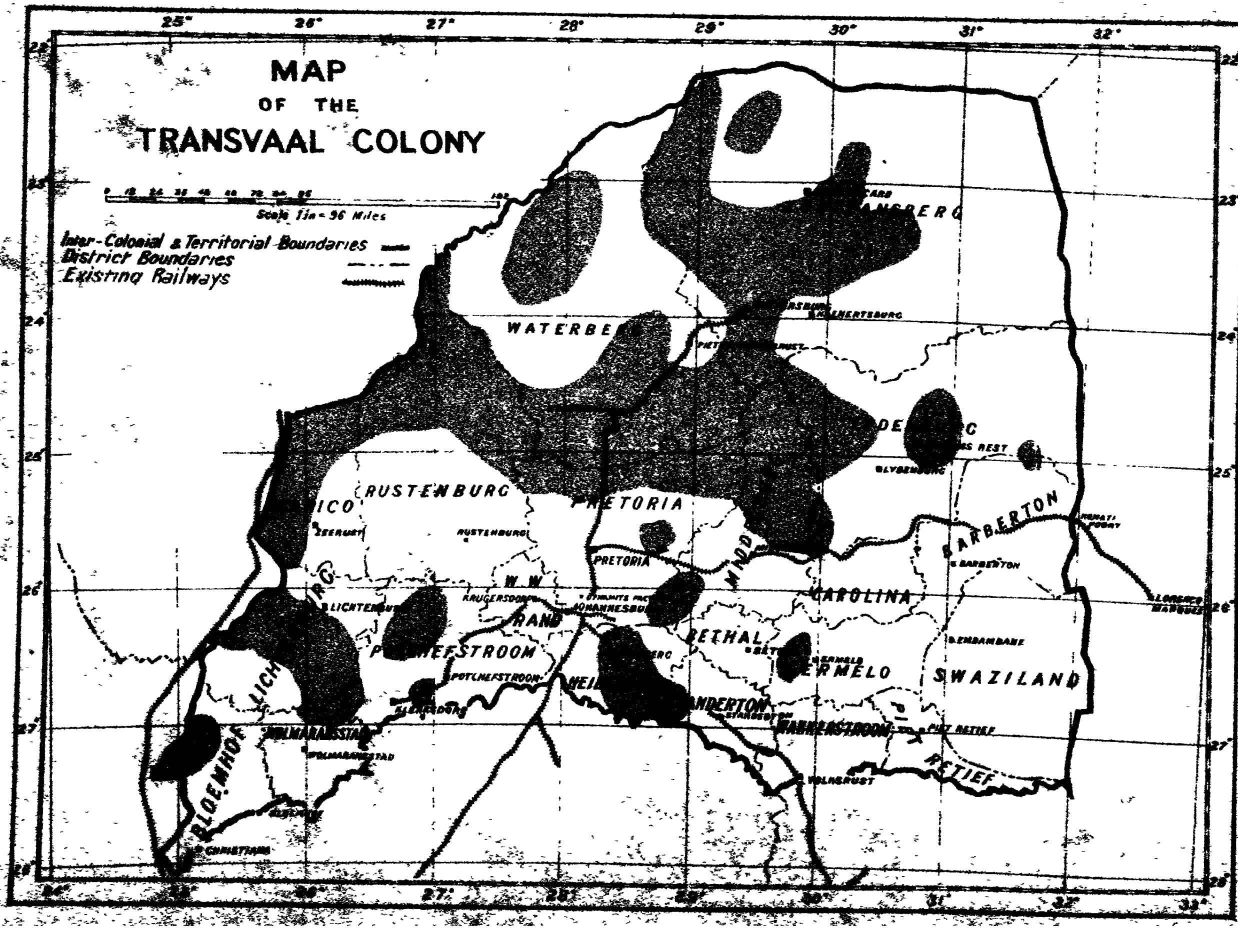
SUMMARY OF EXPENDITURE, ETC., OF RED LOCUST DESTRUCTION WORK—JANUARY TO APRIL, 1908.

Salaries, Transport and Sundries	Cost of Material used	Quantity of Material used: Arsenite	Quantity of Material used: Sugar	Quantity of Material used: Treacle	Number of Swarms Destroyed	Number of Men Employed
		lbs.	lbs.	lbs.		
£1 806 0 0	£292 0 0	7 318	10 482	800	5 923	26
£1 806 0 0	£292 0 0	7 318	10,482	800	5 923	26

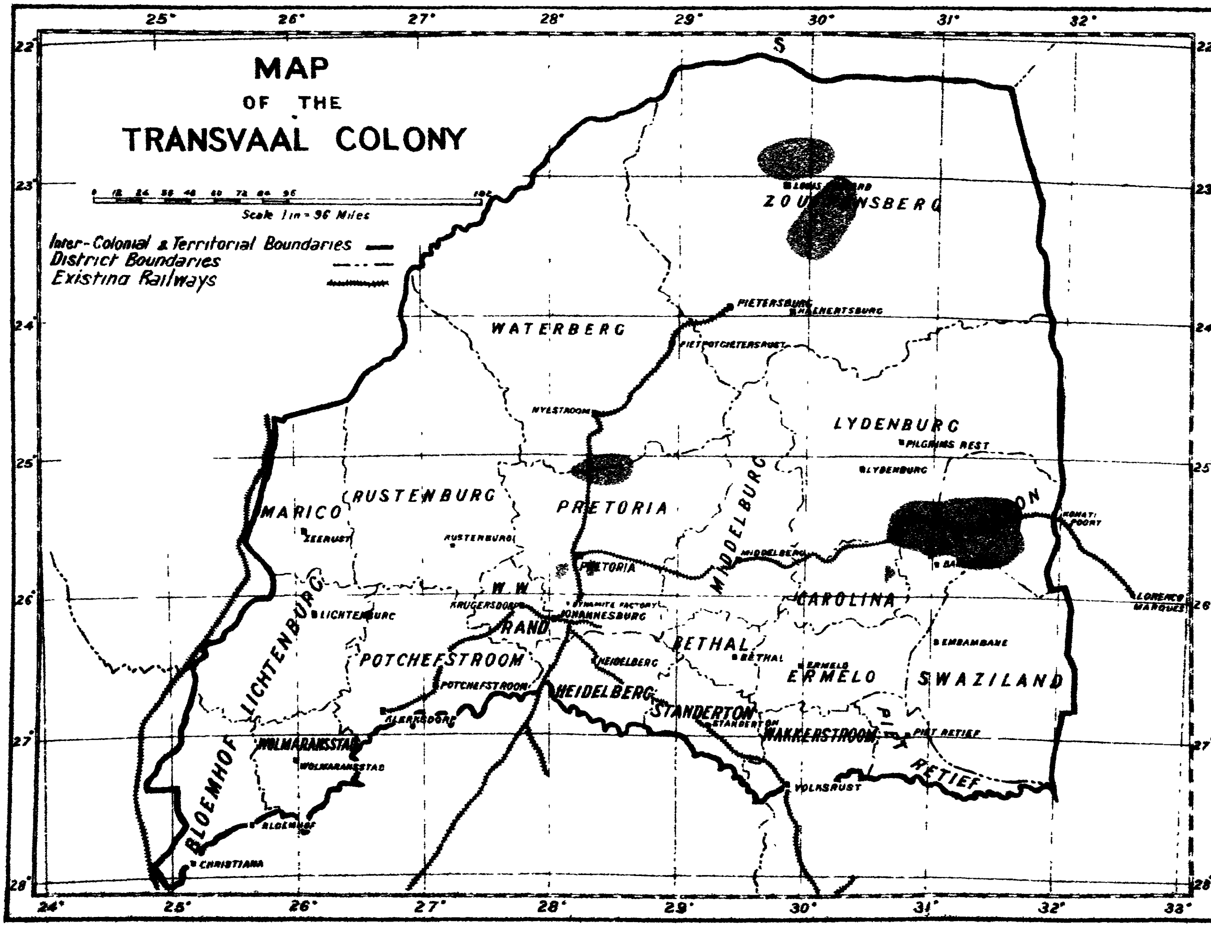
SUMMARY OF EXPENDITURE, ETC., OF BROWN AND RED LOCUST DESTRUCTION WORK—OCT., 1907, TO APRIL, 1908.

	Salaries, Transport and Sundries	Cost of Material used	Quantity of Material used: Arsenite	Quantity of Material used: Sugar	Quantity of Material used: Treacle	Quantity of Material on hand at end of Brown and Red Locust Destruction Work: Arsenite	Quantity of Material on hand at end of Brown and Red Locust Destruction Work: Sugar	Quantity of Material on hand at end of Brown and Red Locust Destruction Work: Treacle	Value of Material on hand at end of Brown and Red Locust Work including spray pumps	Swarms Destroyed	No of Men employed
			lbs.	lbs.	lbs.	lbs.	lbs.	lbs.			
Brown locust work	£8 312 12 9	£1 427 1 1	37 396	42 015	5 424	87 446	11 419	20 000	£2 221 13 11	8,287	135
Red locust work . .	1 806 0 0	292 0 0	7 318	10 482	800					5 923	26
	10 118 12 9										
Add actual cost of material used in brown and red locust work ..	1 719 1 1										
Total	£11 837 13 10	£1 719 1 1	44 714	52 497	6 224	87 446	11 419	20 000	£2 221 13 11	14 210	161

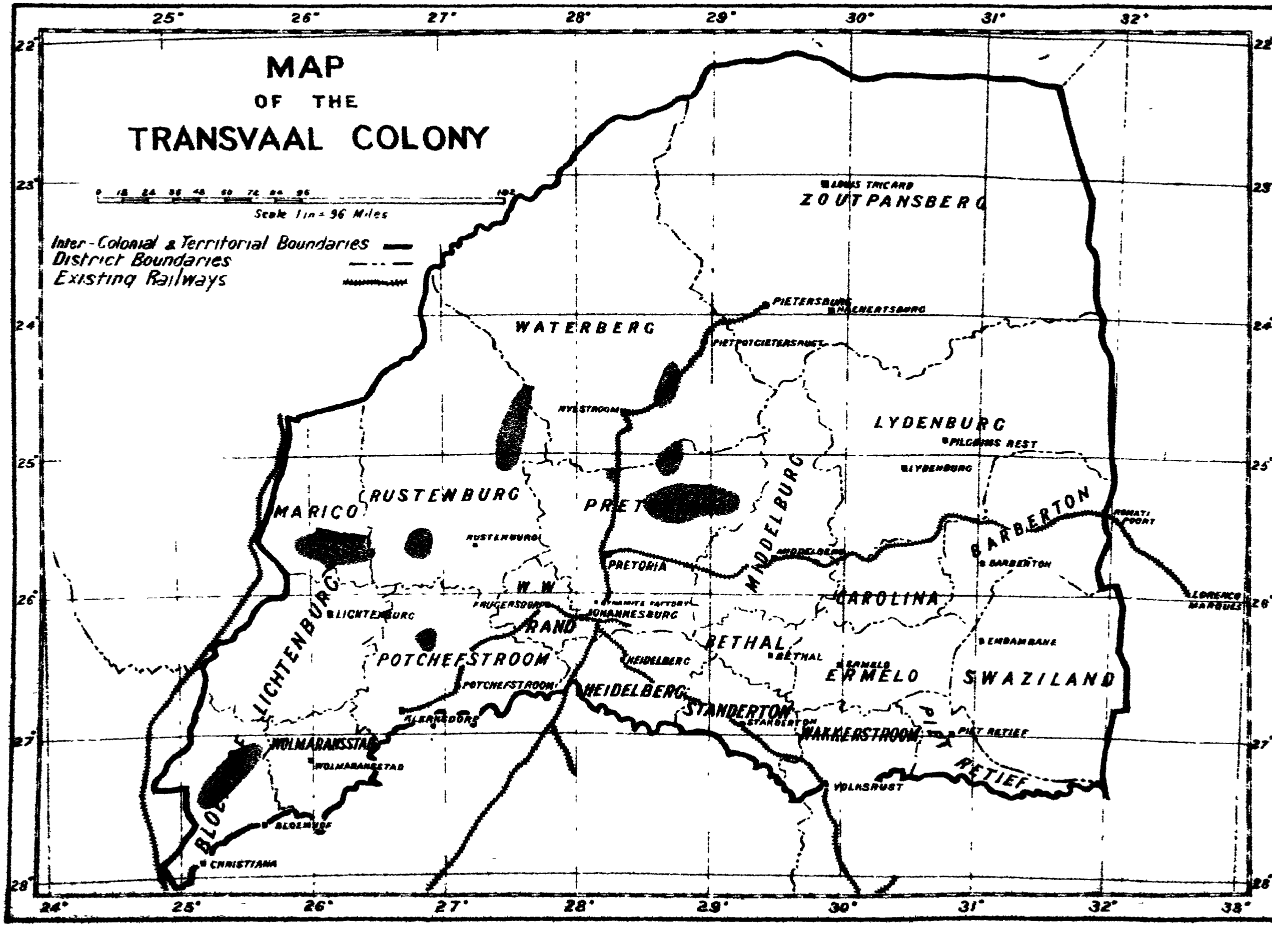
NOTE.—From the above summary it will be observed that the actual cost of the locust destruction work came to £11 837 13s. 10d. including the cost of the material used, and that the value of the material on hand including spray pumps is £2 221 13s. 11d. The approximate number of spray pumps on hand, after deducting those sold to farmers, is 1 400.



MAP SHOWING AREAS INFESTED BY VOETGANGERS OF [illegible]
SEASON 1907-08.



MAP SHOWING AREAS INFESTED BY VOETGANGERS OF RED LOCUST SEASON 1907-08.



FORECAST MAP
BROWN LOCUSTS
EGG LAYING AREA.
1908.

FORECAST OF AREAS IN THE TRANSVAAL WHERE EGGS OF BROWN LOCUSTS HAVE BEEN LAID.

BY DAVID GUNN, Division of Entomology.

FROM numerous reports which we have received, we are able to give the following forecast regarding the areas where eggs have been laid by the brown locust. (Plate 13.)

PRETORIA DISTRICT.

So far as can be ascertained by reports, and numerous enquiries which we have made, the vicinity of Enkeldoorn, the area to the south-east of Moss River, and also along the boundary of Waterberg District, appear to be the only places where the eggs of the brown locust have been laid. It is therefore apparent that we are safe in prognosticating that the work of destruction will not assume the proportions which it did during last season.

POTCHEFSTROOM DISTRICT.

From reports received we find that a small area to the west of Ventersdorp will be infested, so that the work of destruction upon the appearance of the voetgangers will be comparatively short.

BLOEMHOF DISTRICT.

It appears that the infestation in this district will be more extensive than we had anticipated, as the egg-laying area apparently extends for a distance of about forty miles to the east of Harts River.

RUSTENBURG DISTRICT.

From reports received it is evident that the vicinity of Zwartruggens is the only area in this district which will be infested. It is very probable, however, that there may be certain uninhabited portions in the northern busheld where eggs have been laid which have not been reported to us.

WATERBERG DISTRICT.

The areas of infestation in this district appear to be in the northern portions of the Springbok Flats, and along the Nyl River, in the vicinity of Naboom Spruit. Although all areas where eggs have been laid may not have been reported to us, we do not anticipate that the campaign in this district will have to be conducted on so extensive a scale as the one last season had to be.

MARICO DISTRICT.

The egg-laying area is between Ottoshoop and Zeerust, extending along Oberholzers Kloof to Rustenburg District boundary. It must, however, be borne in mind that no reports of egg-laying have been received from the bushveld.

Lydenburg, Lichtenburg, Middelburg, and Zoutpansberg Districts.

With reference to Lydenburg, Lichtenburg, Middelburg, and the Zoutpansberg Districts, the reports which we have received were to the effect that no brown locusts had been observed laying eggs, but on account of the vast uninhabited portions of these districts it is quite possible that oviposition may have taken place in certain areas, which was not brought to the knowledge of the field cornets, South African Constabulary, and farmers. If, however, it is discovered at a later date that eggs have been laid in uninhabited places, no apprehension need be occasioned by such a probable occurrence, as large supplies of arsenite of soda, sugar, and other necessary material are stored at central places in these districts, which will entirely prevent any delay in the work of destruction upon the appearance of the voetgangers.

We have received no reports from Heidelberg, Bethal, Ermelo, Standerton, Carolina, and Wakkerstroom, so that there is a probability that no voetgangers will appear in these districts.

With reference to the Barberton and Piet Retief Districts, it is unnecessary to take these districts into account, as flying brown locusts very seldom visit them.

Although we have endeavoured to make our forecast regarding the areas in each district which will be infested as accurate as possible, we are fully cognisant of the fact that our data regarding certain districts may not be complete; and, consequently, there is a probability that there may be a greater area of infestation than had been anticipated. In order to be fully prepared for such a contingency, arrangements have been made with the men who will be employed as district locust officers upon the commencement of the first heavy rains, that they should collect as much data as possible regarding the egg-laying areas in their districts, and by these means be able to be in a position before the beginning of the work to augment our present forecast.

Since the termination of our last two successful campaigns, the absence of flying locusts in many districts may have engendered in many people a spirit of lethargy, and consequently the sudden appearance of a swarm of flying locusts, and the probable resulting oviposition may have rendered them careless regarding the reporting of the same: but if our campaign against the voetgangers of the brown locust is to be carried out in a successful and systematic manner, it is obviously most essential that we should receive reports of areas where eggs have been laid, on the appearance of voetgangers, however insignificant the matter may appear to be.

Our supply of arsenite of soda and spray pumps is sufficiently large for the coming season's work. In addition to large supplies being stored in the districts where work will have to be conducted, we have an ample reserve supply stored at Pretoria. In connection with the spray pumps, it may be stated that a large number have been sold during the past year to bona fide farmers upon condition that they should be used in future locust destruction campaigns, so that it will be unnecessary to distribute pumps to these men.

Whilst we are receiving great assistance from the Transvaal Police, Railway, and other officials in the reporting of flying locusts, and areas where eggs have been laid, we find that our most important source of information is derived from the reports despatched by the Field Cornets; in fact, so valuable has been the data which we have received from these officials that in the majority of cases our forecast upon the areas of infestation in several districts have been compiled entirely from their reports. However energetic the Field Cornets and Transvaal Police may be in the reporting of such matters, it is impossible to expect that they can ascertain every place in their respective wards where eggs have been laid without the co-operation of the farmers. For the purpose of obtaining the necessary assistance from farmers and others, thousands of post cards have been printed in both languages and despatched to Field Cornets and Transvaal Police in order that they should be distributed amongst the people.

With reference to the red locusts, it is impossible at the present date to state where eggs will be laid, as these locusts only commence oviposition during November.

THE BROWN LOCUST CAMPAIGNS OF SOUTH AFRICA.—SEASON 1907-8.

By M. Kent Willis, Division of Entomology.

Ever since the Inter-Colonial Locust Conference, opened by His Excellency the High Commissioner for South Africa, in the Palace of Justice, Pretoria, on the 17th May, 1907, the various Colonies and Administrations in South Africa have, metaphorically speaking, put their hands to the plough, and have taken up the work of locust destruction in a spirit of whole-hearted co-operation which cannot sufficiently be commended, and in looking over the reports on the locust compaigns of 1907-8, submitted by the various territories to the Central Locust Bureau, three very important factors in the work of extermination seem to stand out most prominently. These are (1) the whole-hearted spirit of co-operation with which the Colonies have entered into the work; (2) the completeness and efficiency of their different organisations; and (3) the universal adoption of the arsenite of soda spray as a means of extermination when used against the locust in the voetganger stage.

If the work of locust destruction in South Africa is ever to carry with it any lasting effect, it must be carried on in a thorough, efficient, and whole-hearted manner, not by the individual Colony or territory, but by each individual Colony co-operating with its neighbours to bring about the desired result. This consummation, devoutly to be wished, appears, from the reports of last season's campaigns, to have been accomplished, and it is a matter for hearty congratulation that the problem should have been tackled in so earnest a manner and in

such a spirit of co-operation by every territory in South Africa south of the Zambesi. Even German South-West Africa and Portuguese East Africa, to say nothing of Swaziland and Rhodesia, Basutoland and Bechuanaland, appear to have entered into the spirit of the wholesale extermination of one of the greatest insect pests known to civilisation, with an energy which is bound to have, if it has not already had, great results, and which it is to be hoped will ultimately rid South Africa of this fearful scourge.

The results of the last season's campaigns, which the reports show to have been accomplished, could never have been brought about without sound administration and efficient organisation, and this the reports prove to have been the rule and not the exception. The methods of organisation adopted by the various administrations appear to vary in detail, but each organisation appears to have been adapted to the varying conditions existing in the territories in which it has been applied, and it is a matter of supreme indifference as to which method is considered the best so long as the results are equally satisfactory. In the Cape Colony, Transvaal, and the Orange River Colony the method of organisation does not vary in essential detail. In Rhodesia, Basutoland, and Bechuanaland the methods of organisation are different, and are adapted in order to meet the varying conditions pertaining in those territories. For instance, Basutoland, which is for the most part peopled with a native race, rely to a great extent upon their native chiefs in carrying out the details of the work. Rhodesia, on the other hand, relies more upon her police officials, railway gangers, and natives, and Bechuanaland almost entirely upon non-commissioned officers at the various police posts, and the co-operation of the white settlers. Of course in the Cape Colony, Orange River Colony, and Transvaal, where departmental equipment exists on a much larger scale, and where the countries are much more densely populated with white people, the methods of organisation are much more elaborate and complete. But whatever methods of organisation have been adopted the results seem to have been equally satisfactory.

The universal adoption of the arsenite of soda spray as a means of extermination seems to confirm the opinion that for cheapness, simplicity of application and effectiveness, it cannot be surpassed. Other methods appear to have been tried with varying degrees of success, but all have been found wanting in one important detail or another. Other arsenicals have been experimented with, such as Hansen & Schrader's "Locusticide," "Fletcher's Dip," and others, but as these are still the subjects of experiment, it would be invidious on my part to comment upon their effectiveness.

The total cost of the brown locust campaigns throughout South Africa may be estimated, roughly, at something like £32,000, exclusive of the cost of material. This would, on the face of it, appear to be a very large sum of money to spend on locust destruction, but if accurate statistics regarding the amount of money representing the crops saved could be obtained, it would probably be found that the amount expended in this work, even including the cost of material, would amount to less than 1 per cent. of the value of the crops saved.

The Cape Campaign.

Cape Colony appears to have had a very successful campaign at a cost of something like between £8,000 and £10,000. These figures are only approximate, as the actual amount expended is not mentioned in the report. £5,000 was the amount voted for the work, but it is more than probable that the higher figures are nearer the mark. As this is the first campaign in the Cape in which the arsenite of soda spray has been in general use, they are to be congratulated upon the comparatively small number of stock poisoning cases which have occurred, and which are unavoidable where gross carelessness and flagrant disregard to instructions occasionally happen. They appear to have been labouring under some difficulties at the commencement of the campaign on account of the attitude taken up by many of the farmers against the use of the arsenite spray, but this is not to be wondered at when one takes into account the reports of the number of stock poisoning cases which reached them from the Orange River Colony in the early stages of the campaign, and when the preachers of the gospel of locust destruction were newly in the field. Objections to locust destruction on the grounds of religious scruples also appear to have played no unimportant part in rendering the difficulties experienced in the initial stages of the campaign greater than would have otherwise been the case. But the Cape farmer is new to the work, and it is pleasing to note in the report that the prejudice which existed in the early part of the work was fast disappearing towards its termination, and the natives were reported as being easily persuaded to use the arsenite of soda spray.

According to the report, 14 tons of arsenite of soda were used, 14 tons of crude sugar, 3 tons of treacle, and 1,500 spray pumps were in operation.

From 10,000 to 20,000 swarms were reported to have been destroyed, and 2 horses, 2 sheep, 13 calves, and 41 cattle were supposed to have met their deaths by arsenical poisoning.

The organisation consisted of the Government Entomologist as chief locust officer, two district locust officers, and 29 field men; a central depot for the issue of supplies was established at Naauwpoort, and each seat of magistracy became a sub-depot for the issue of supplies and the carrying out of the minor details of the work.

Space will not permit of my going into further details with regard to the Cape campaign, but it is encouraging to note that the promises made at the Locust Conference in May of 1907 by the Hon. A. J. Fuller, who stated that: "*I am determined that whatever you do here we, as a Government, are going to help you,*" have been carried out to the letter, and in a spirit of earnest co-operation which is more than encouraging.

The Orange River Colony's Campaign.

The cost of the Orange River Colony campaign is estimated at £7,492 2s. 10d., which is exclusive of the cost of material, and this amount, taking into consideration the work accomplished and the huge areas over which the work was distributed, compares very favourably with that of the other Colonies.

When we take into consideration the fact that in this Colony a compulsory Act for the destruction of locusts, similar to that in force in Natal, is in existence, it is a matter of no insignificant importance to note that in only two instances was it found necessary to bring into force the penalty clauses of the Act. This in itself speaks highly in favour of legislative measures being brought to bear upon this most important question of locust destruction, and seems to point out the fact that on the whole the co-operation of the farmers in the Orange River Colony was satisfactory. The report further states that "the natives worked well in assisting the officers."

It is much to be regretted that the number of stock poisoning cases in the Orange River Colony is comparatively large, and of such a serious nature as to warrant their being the subject of special enquiry; but, in fairness to that Colony, it should be stated that at the commencement of the campaign their officers were entirely new to the work, their knowledge of the dangers attending the use of the arsenite of soda spray was meagre, and carelessness on the part of the farmers, and, in many instances, flagrant disregard to instructions given, played no unimportant part in swelling the number of stock poisoning cases in that Colony. But as the work progressed, and the farmer became more accustomed to the use of the spray, and carefulness and strict adherence to instructions became the rule and not the exception, it is satisfactory to note that the cases of stock poisoning very considerably diminished in numbers.

The amount of material used in the Orange River Colony is much in excess of that used in the Cape and Transvaal, but no account appears in the report of the amounts of material on hand at the termination of the campaign, and it is uncertain whether the amounts given are to be considered as the amounts of material actually used during the campaign or not. From the report it would appear that 43 tons of arsenite of soda had been used, 98 tons of sugar, 40 tons of treacle, 593 gallons of Fletcher's dip, and 5,000 spray pumps were in operation.

The number of swarms actually destroyed, or rather those actually reported as having been destroyed, is 3,335, but here again it should be stated that so much difficulty was experienced in gathering reliable data under this heading that the idea of obtaining it had to be abandoned, and the figures given are really those obtained from only two sources which appeared to bear the stamp of accuracy.

The Transvaal's Campaign.

The exact cost of the brown locust campaign in the Transvaal is £8,312 12s. 9d., and this amount is, roughly speaking, some £2,000 below the cost of the campaign in the previous year. This reduction in cost may or may not have been, to a certain extent, the direct result of co-operation on the part of the other Colonies, for it will readily be admitted that the more assistance we receive from the outside Colonies the less expensive will become each individual Colony's campaign.

According to the Transvaal report, the co-operation of the farmers has been much more general than in former years, but there is still room for improvement. Considerable annoyance appears to have been

caused by the natives in the earlier stages of the campaign refusing to assist in the work, in some cases even going so far as to seek legal advice upon the matter, but it is a pleasure to note that immediately the attention of the Minister for Native Affairs was drawn to the fact, the attitude of the natives altered, and the work was carried out by them in a much more harmonious spirit.

Owing to the fact that the Transvaal farmers are becoming, through experience, much more accustomed to the use of the arsenite of soda spray, the number of cases of stock poisoning has been brought to an almost irreducible minimum.

The amount of material used in the Transvaal campaign is approximately 18 tons of arsenite of soda, 21 tons of crude sugar, 5,424 lbs. of treacle, and some 1,200 spray pumps were in operation. The number of swarms of voetgangers actually reported as having been destroyed is put down at 8,287, but it is more than probable that double this number were actually disposed of. The difficulty in arriving at the actual number of swarms destroyed is accounted for from the fact that no one Colony agrees with another as to what an actual swarm of locusts really is, and no officer, operating even in the same district with another, will agree as to the exact dimensions of a swarm of locusts.

The organisation in the Transvaal consisted of the Government Entomologist as chief locust officer, one assistant chief locust officer, 13 district locust officers, 16 sub-district locust officers, 83 assistants, 18 storekeepers, and three on the office staff.

The Rhodesian Campaign.

Perhaps no more satisfactory and encouraging report exists than that from Rhodesia, the cost of whose campaign is estimated at £4,630, which is exclusive of the cost of material. Some misapprehension appears to have occurred in the minds of those in authority as to the actual amount of co-operation to be expected from Rhodesia, probably due to the absence from the Inter-Colonial Conference of their representative, whose absence was solely due to the fact that their Legislative Assembly was in session at the time. But whatever doubts there might have been in the minds of those best in a position to judge, these doubts must have been immediately dispelled after a perusal of the report from that territory, which exhibits in a most unmistakable manner the earnest desire on their part to do all they could to assist in the universal work of extermination.

The words apathetic and antagonistic are used in connection with the attitude taken up by the white settlers, and the difficulties under which Rhodesia laboured during the early part of its campaign seems to have been accentuated by this spirit of apathy. Whether this is due to the employment of police officials as locust officers or not is a moot point, but, at any rate, a considerable amount of difficulty appears to have occurred in persuading the white settlers to undertake the work. As a pleasurable contrast to the antagonistic attitude taken up by the natives in the Transvaal comes the report from Rhodesia that the "Natives were much easier to work with than the whites, and some excellent work was done by them."

Considering that most of the work in Rhodesia was done by natives, the number of stock poisoning cases is comparatively small, they having been credited with losing only 24 goats, 2 sheep, 2 donkeys, and 25 cattle.

The material used was 20 tons arsenite of soda (plus 1½ tons of arsenite available from last year), 35 tons of crude sugar, and 400 spray pumps were in operation.

The number of swarms accounted for is 14,109, which appears to be as accurate an estimate under this heading as it is possible to compile.

The organisation consisted of 50 police officers (struck off all other duty), each officer authorised to employ six natives; 10 special locust officers with transport and six natives each, railway gangers, and natives.

The Basutoland Campaign.

The cost of the Basutoland campaign is estimated at £1,850, exclusive of the cost of material, but lack of space will not permit of my entering into further details regarding the work carried on in this territory and in Bechuanaland and German South-West Africa, further than to state that in Basutoland the Administration seem to have relied mostly upon the native chiefs for carrying out the minor details of the work, whilst the lack of details regarding stock poisoning seem to point to the fact that no such accidents have occurred, and in this connection Bechuanaland distinctly states that no cases whatever have been reported. The organisation in Bechuanaland consisted of non-commissioned officers at the various police camps, who were assisted by the natives, with a chief locust officer appointed to superintend the work. The number of swarms destroyed is put down as between 200 and 300, but no details are given regarding the amount of material used.

With regard to the question of legislation, which crops up in nearly all the reports, there appears to be sufficient evidence to prove the urgent need of legislative measures being immediately brought into force in the Cape Colony and the Transvaal and Rhodesia. In Basutoland a compulsory Act is found to be unnecessary on account of the fact that, being populated for the most part with a native race, it is found that the chiefs have sufficient control over the natives under them to be able to enforce what measures are considered necessary. Bechuanaland, on the other hand, seems to be blessed with a race of white men, who, to use the words of Mr. McKellar, the chief locust officer for that territory, "to the last man were anxious to do all they could."

There is yet one other point in these reports worthy of mention, and that is the remarkable unanimity of the various Administrations in commenting in their reports upon the unqualified assistance rendered in this work of extermination by the many different species of locust birds. Several of the Colonies have drawn attention to the fact that the number of these natural allies is steadily on the increase, and in many instances birds which have not heretofore been looked upon as locust-eating birds may now be safely classed as such.

In concluding this summary of the work accomplished in the brown locust campaigns of South Africa during the season 1907-08, I need only add that it appears to me that the measures of success achieved amply justify the actions of the various Administrations in South Africa in undertaking a work of such magnitude, and have proved beyond the shadow of a reasonable doubt that it only needed concerted action by all the South African Governments, and an expenditure of a sum of money infinitesimal when compared with the value of the crops saved, to so far minimise the locust plague in South Africa that it would cease to be a menace to the prosperity of the farming community.

The Horticultural Section.

SMALL PARCELS OF FARM PRODUCE BY POST AND RAIL.

By R. A. Davis, Government Horticulturist.

There is no doubt but that the cost of living is greater in the Transvaal to-day than in almost any part of the Empire.

The installation, therefore, of a cheap special rate for farm produce by the "Collect on Delivery" system of the Central South African Railways, and the introduction of an Agricultural Parcels Post by the Postal Department, should at once appeal both to consumers and producers, from two points of view.

It enables both parties to buy and sell direct without any intermediary profit-taking, and also ensures to the purchaser a supply of fresh reliable produce at regular intervals. On the one hand, how satisfactory it should be to dwellers in town to get fruit, butter, eggs, and poultry fresh from the farm, delivered at the door once or twice a week; and, on the other, how welcome the weekly cash receipts. Too much credit cannot be given to the departments mentioned for affording these facilities. It remains for the public generally to show their appreciation by making use of them to the fullest extent. It is no use sending away any kind of produce from a farm unless it will arrive in good order at its destination. Butter, for instance, may be of excellent quality, and fruit of the very best, but if they are delivered to a customer in any other than perfect condition, they are quite likely not to be wanted at all. Therefore, it is necessary that attention should be given to the kind of package one is going to use. Uniformity of size and shape should be studied, and also the method of how best to pack the contents.

This is not difficult with regard to butter and eggs. Neat and suitable boxes for both are to be purchased at reasonable rates, but with fruit the question is a little more difficult.

To travel safely and arrive in good order, fruit must be packed properly. If it is put in the box too loosely it gets shaken about and bruised; if, on the other hand, it is packed too firmly, it is liable to bruise also; and if soft fruits are treated in this way, the juice may escape and set up fermentation and decay, besides possibly injuring other packages in transit.

The object of this paper is to show how fruit may be safely packed. The best package for carrying fruit is a wooden box, and such may now be purchased both in Pretoria and Johannesburg, in sizes suitable for transmittal either by post or rail, at a moderate cost. It is hoped when the fruit season 1908-09 arrives that arrangements may be made for boxes to be supplied at a lower rate than exists at present.

The box of plums (Plate 14) shows, perhaps, the best method of packing soft fruits. The material used for filling is wood wool. This is absorbent of moisture and desirable on that account, as well as because it keeps each fruit in place and prevents bruises. The method adopted

is to place a layer of this material in the bottom of the box, then place the fruit in it, one row at a time, with a thin layer between each row, until the box is full, then another layer is placed over the whole and the cover nailed down.

With specially fine fruit, each specimen should be wrapped in soft paper, which may bear the name and address of the grower. This will keep the fruit clean and nice, and act as an advertisement; but the best notice one can secure is always obtained by sending out the very best possible fruit only.

It is a mistake to pack specimens injured by hail or marked with insect bites, and so on. Small and ill-formed fruit should be rejected as likely to prove of actual injury to the grower.

The Superintendent of Dairying makes the following note :—

For the packing of butter great care should be taken to select for the box a variety of wood that emits no smell. Butter readily absorbs smells, and can be easily tainted in this way.

In Europe, Canadian poplar wood is considered the best for this purpose, and large quantities of this wood are imported by some countries specially for making butter-boxes.

An important point in packing butter is that the box should be filled completely, else the butter may suffer in transit by the shaking.

Butter should never come into contact with the wood of the box. Great care should be taken to wrap it in parchment paper before placing it in the package.

Central South African Railways.

"Collect on Delivery" System.

The Department has adopted what is known as the "Collect on Delivery" system, applicable in local traffic and through traffic with the Cape and Natal Government Railways, in through traffic with the Beira and Mashonaland Railways for stations in Rhodesia, and in through traffic with Rhodesian Railways (Vryburg-Bulawayo section).

The system is briefly this: The Railway Department collects from the consignee the declared value of consignments (other than live stock) on delivery of same, on behalf of the sender, the receiving station remitting the amount through the sending station to the sender.

The rates of commission for collecting from consignees on behalf of sender the amount to be recoverable in respect of the value of the consignment are, viz. :—

Locally over Central South African Railways and in through traffic with Cape Government and the Rhodesian Railways (Vryburg-Bulawayo section):

		£	s.	d.		Pence.
Not	over	0	6	8	commission	1
"	"	0	13	4	"	2
"	"	1	0	0	"	3
"	"	2	0	0	"	4
"	"	5	0	0	"	6

Each additional pound or part thereof 1d., maximum £100.

In through traffic with the Natal Government Railways and Beira and Mashonaland Railways, the rates of commission are as above, with the exception that the minimum charge made is 3d.

These rates are payable even though the collection of value is not effected to recompense the Department for services which, though ineffectual, will exceed those rendered if the consignments were delivered in the first instance.

A sender wishing to take advantage of the "Collect on Delivery" system should hand the package, fully and legibly addressed, which he wishes forwarded, to the officer at the sending station appointed to receive the same, together with a consignment note, which, in addition to the usual particulars, must show the amount to be collected from the consignee for and in respect of such package, irrespective of railway freight, any special instructions regarding delivery, etc., he desires carried out, together with an account giving detail of contents of such package or packages.

Attention is also directed to the fact that in order to meet the convenience of merchants, etc., not having sufficient traffic to warrant the opening of a ledger account with the Department, it has been decided to accept deposits at stations to meet freight on goods either forwarded or received. Further information with regard to these arrangements can be obtained from the station masters at any station in the Transvaal or Orange River Colony.

* * * *

AGRICULTURAL PARCEL POST.

Commencing on the 1st January, 1908, parcels containing articles produced or, if manufactured, produced and manufactured wholly within the Transvaal, will be accepted at all Post Offices in the Transvaal for conveyance by post to any place within the Transvaal at the following rates:—

Up to 1¼ lb., 3d.
Over 1¼ lb. and not more than 3lbs., 6d.
Over 3 lbs. and not more than 6 lbs., 8d.
Over 6 lbs. and not more than 9lbs., 10d.
Over 9 lbs. and not more than 11 lbs., 1s.

If desired they may be registered on payment of an additional fee of 4d.

No parcel weighing more than 11 lbs. will be accepted. The maximum dimensions will be the same as for the Inland Parcel Post, viz.: Length, 3½ feet; length and girth combined, 6 feet, and the general regulations of the Inland Parcel Post will apply to the Agricultural Parcel Post.

The Agricultural Parcel Post will be for parcels from and to places within the Transvaal only. All parcels for places outside the Transvaal, whether containing Transvaal produce or not, must be prepaid at the ordinary Inland Parcel Post rates.

Parcels for conveyance by the Agricultural Post must not be posted in a letter box, but handed in at the Post Office counter.

The senders will be required to sign a declaration that the contents are the bona fide produce or, if manufactured, the produce and manufacture of the Transvaal.

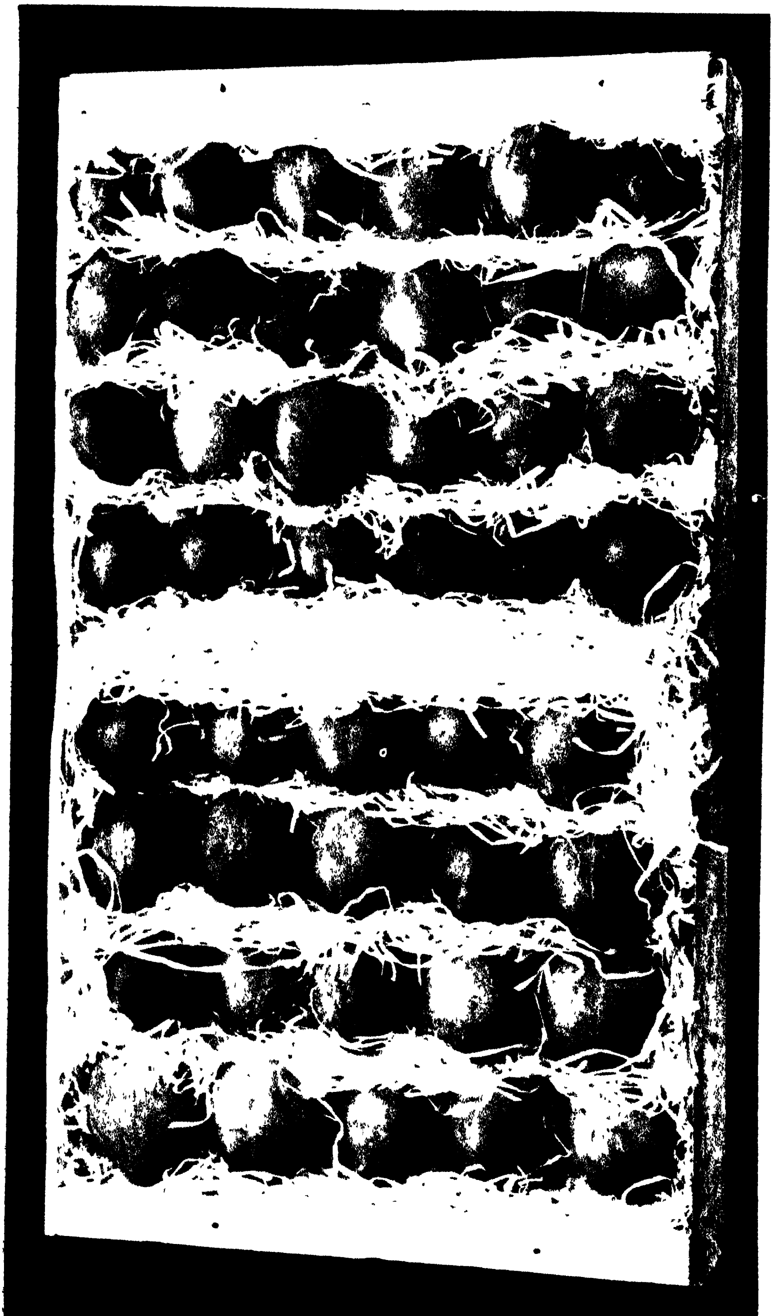


Plate 14.

A Box of Plums.

Showing method of packing soft fruits in wood-wool

Plate 15.

Citrus Trees at the Government Experimental Orchard, Warmbaths.

Fig. 1. St. Michael on Orange Stock. Fig. 2. Homosassa Orange on Lemon Stock. Fig. 3. Mandarin on Lemon Stock.

The following articles may, under the conditions stated above, be sent by the Agricultural Parcel Post:—

Butter.	Dried Meats.	Dried and Bottled Fruits.
Eggs.	Jam.	Flowers.
Poultry	Honey	Seeds
Bread.	Tobacco	Plants
Biscuits	Cigarettes	Vegetables
Yeast	Confectionery	Leather (unmanufactured)
Fresh Fruit	Sugar	Wool Samples

But the service will not be restricted, and the new rates will apply to parcels containing any articles produced and, if manufactured, produced and manufactured within the Transvaal. Parcels by the Agricultural Parcel Post may contain an invoice, but not a letter or anything in the nature of a letter.

They must be packed in such a manner that the contents will not *injure* any other postal packet.

For parcels post it is suggested that boxes of the following sizes will prove useful:

15 in. x 9 in. x 2 in., weight 1½ lbs.
18 in. x 12 in. x 2½ in., weight 2 lbs.

The weight of the box of plums shown was just under 5 lbs., so that it might have been sent to any part of the Transvaal for 8d. For transit by rail, larger packages may of course be used. Standard sizes are:—

18 in. x 12 in. x 3 in.
18 in. x 12 in. x 5 in.
24 in. x 12 in. x 3 in.
24 in. x 12 in. x 6 in.
24 in. x 12 in. x 8 in.

California crates, 17½ in. x 17½ in. x 4½ in., with four chip baskets. These boxes are usually included in the price of the fruit and are non-returnable.

The packing of fruit in baskets is undesirable from every point of view. In fact so much does the Cape Government Railway object to carrying it in this way that a special increased rate has been framed with the object of putting an end to such traffic.

ON CITRUS STOCKS

By C. A. Simmonds, F.R.H.S., Assistant Horticulturist.

A good deal of attention has been paid by the Horticultural Division to experiments with different stocks for citrus trees, and as an outcome of this some very interesting results have been obtained on the station at Warmbaths. (Plate 15.)

I would like to say a little about one or two of the most striking examples of the suitability or otherwise of some of these stocks for the Transvaal.

Some time ago certain plots of ground were set aside for stock experimental purposes. An analysis of this soil by Mr. R. D. Watt, Acting Chief Chemist, who reports as follows, is given:—

"The sample submitted to me may be said to represent the best of Waterberg soils.

	Per Cent.
Stones retained by mm. sieve	8.31
The air dry "fine earth" contained moisture	1.32
* Loss on ignition (organic matter, etc.) ...	2.72
Insoluble matter (sand, etc.)	89.68
Iron of oxide and alumina	6.24
Lime	0.06
Magnesia	0.04
Potash	0.09
Phosphoric acid	0.04
Total	100.19
* Containing nitrogen	0.057
Available potash	0.0134
Available phosphoric acid	0.0028

"It belongs to the better class of Transvaal sandy soils, but shows the characteristic deficiencies of such soils in organic matter, nitrogen, lime, and phosphoric acid. Its physical condition is excellent, and it ought to make a good soil for fruit trees, though too poor to stand cropping for any length of time without manure."

. . . .

About a hundred of each of the following were planted, viz., Pomelo, Shaddock, Rough Lemon, Sweet Orange, and Florida Sour. I purpose dealing more particularly with the three last-named.

Florida Sour.

This stock came from Florida with a reputation as a good all-round stock for soils containing a liberal supply of moisture. In Florida it grows best on the banks of the rivers, where the soil contains plenty of moisture and humus. According to the statements made by Professor Hume it is not subject to the attack of collar rot, and it is stated that it has been used with success in building up old orchards that have been devastated by this disease. Further, the roots are produced abundantly, and penetrate deeply into the soil; therefore it is not readily affected by variation of moisture.

Although trees worked on this stock are not very fruitful the first few years, the fruit, however, is of good quality from the start. Such is more or less the behaviour of this stock in Florida.

I would now like to say a little about my experience with it here. Nothing can be definitely stated yet as to its power to resist collar rot, as it has not been tried to any extent in any section where this disease is prevalent. Here, as in Florida, it produces a good root system, and the tree grows splendidly, notwithstanding the light, dry sandy nature of the soil. It has shown itself slightly subject to scab, a disease which attacks the leaves and young twigs. It compares very favourably with the rough lemon as a quick growing tree, and grows much faster than the sweet orange. So far, so good, but as

we wanted something more than an ornamental tree, carrying uneatable fruit, we started to work them over to nineteen different varieties of citrus, and then the trouble began.

All the different stocks were budded as near the same time as it was possible to do it, so that a fair test could be made.

Fruit Season.

No difficulty was experienced in budding on the Florida Sour in the first place, and a high percentage of buds took. Some remained dormant, some made a very sickly unsatisfactory growth, while others grew well for a time and looked extremely promising.

Second Season.

The buds that were dormant through the winter made a feeble attempt to grow.

The sickly ones died, and those that grew well the first season turned yellow, and are gradually dying back. The result to date is that at the end of the second season there is not one single healthy tree out of the hundred budded, and there is no doubt in a few months' time there will be nothing left but a lot of dead stumps.

Just alongside, on the same soil, there are about 200 lemon and sweet orange stocks budded over at the same time as the Florida Sour, and there is a tremendous contrast between them.

The trees on lemon and sweet orange, with few exceptions, are doing splendidly, and are growing into fine healthy trees. Some of them standing 4 feet 6 inches from the point of union.

A good range of varieties were budded on these stocks, as the following list will show:—

Mandarin.	Jaffa.
Flat Mandarin.	McCord's Seedless.
Washington Navel.	Nonpariel.
Ruby.	Satsuma.
Valentia Late.	Christiana Seedless.
Du Roi.	Navelencia.
Marsh's Seedless.	St. Michael.
Natal Victoria.	Early Oblong.
Malta Blood.	Spanish Lemon.
Homasassa.	

With the exception of the last-named there does not seem to be the least affinity between the Florida Sour stock and any of the abovementioned varieties Such being the case appearances are very much against this stock being a success on our dry light soils. Some time ago the writer was asked to inspect some imported trees that had not done at all well. On examination the trees, which had been planted seven or eight years before, were found to be worked on Florida Sour roots. In one instance the stock had outgrown the graft, and was doing well. My experiences with this stock have been so consistently disappointing that I have no hesitation in condemning it here. As mentioned before the tree grows well when not worked, but as soon as it is worked over, and the bud has grown sufficiently to necessitate the leading down of the stock, a complete change sets in, and the whole tree sickens and dies down. There is no apparent affinity between the stock and the bud.

It was thought at one time that this was due to the fact that buds used were taken over from trees that had been worked on other stocks for a good many generations, and in consequence were so influenced by these stocks that it was not possible for them to have any affinity with a strange and uncongenial newcomer. To prove whether this was the case, a trial was made with buds taken from a seedling tree. The result was the same as in the cases mentioned.

There may be a possibility of overcoming this difficulty by starting with uncontaminated bud-wood, and by successive budding specialise some varieties to this stock.

Sweet Orange Stocks.

Nearly all the eighteen varieties worked on this stock have done well, and in some instances have put on more growth than those on lemon. It is noticeable that trees grown on this stock suffer very much from variations in moisture conditions of the soil. During a long spell they show signs of being affected by drought long before those on the lemon. This is no doubt due to the fact that the root system of this stock does not possess the great foraging power of the rough lemon.

It has been long understood that the sweet stock is very susceptible to attacks of the much dreaded disease collar rot. This has been the principal objection to the sweet orange as a stock.

So far, owing to all the trees at this station being young, it has not been possible to prove this here, but in some countries there is a decided objection to this stock for that reason.

The first fruits are certainly much ahead of those grown on lemon, both in appearance and sugar contents. Trees grown on this stock seem to be slow in starting to bear, but this is not altogether a serious drawback, as it gives the tree time to develop before it is subjected to too much strain.

There is a tendency shown by some varieties to outgrow the stock, and it has been noticed even in the nursery that the circumference of the top is very often greater above the union than below it.

* * * *

Common or Rough Lemon Stock.

The best results so far have been shown by trees worked on this stock. Doubtless there is more mutual affinity between this stock and most citrus varieties than any other. In fact, trees worked on it seem to be too much subject to its influence as is evidenced in the shape of the top, the decidedly lemony nature of the first fruits and early bearing. As regards the early fruiting of sweet oranges worked on this stock, there seems to be no advantage gained because the fruit for the first season or two is not of much value, owing to its acid raggy nature. Experiments are in hand to prove exactly the amount of influence this stock has over sweet oranges. The experience of other countries is that the Navel bears more prolifically on it than any other stock. An effort is being made to test this here. The Department has imported some budwood from Riverside, California, so that we have pure budwood to work with. The experiment should be most interesting, as it will help to prove whether the Navel oranges we have here have degenerated or

improved. There are those who maintain that the Transvaal Navel orange is not to be compared to the oversea fruit.

This is doubtful, as the writer has had the pleasure of seeing and tasting some of the finest Navel oranges in this country that one could wish for.

Rough lemon is the stock most used by nurserymen, not only because of its being the most accommodating, but on account of it proving itself the most reliable up to the present. If it were not for collar rot, the sweet orange stock would be preferable. There is no reason why it should not be used, and it would give good results provided the trees are planted, irrigated, and cultivated properly and carefully tended as they should be. Steps are being taken to test other stocks not mentioned here, and it is quite within the range of possibility that a stock will be found to embrace all the most desirable points. Should this be the case it will help considerably what will eventually become a great industry, "*the cultivation and export of citrus fruits.*"

The Dairy Section.

THE JUDGING OF BUTTER AND CHEESE.

By Robert Pape, Superintendent of Dairying.

By acting as judge for the exhibits in butter and cheese at some of the Transvaal Agricultural Shows, I had an opportunity of forming an opinion about the system of awarding prizes. It strikes me that the present system is not quite fair to all parties. The number of prizes is limited, and sometimes a difference of opinion arises between judge and show committee.

The judge may feel disinclined to award a prize, as he thinks even the best exhibit does not merit it. The show committee, on the other hand, wants to encourage exhibitors, and would sometimes like to see prizes awarded even if the exhibits do not quite come up to the standard.

Then, again, butter or cheese that cannot get a prize at all at one show because two exhibits are better might have taken first prize with flying colours at some other show. I remember a case in point where one exhibit with 70 points out of a possible 85 could get no prize, and another show where, at the representation of the show committee, I had to *lower* the limit for a first prize to 69 points so as to squeeze in a first prize. That exhibit of 70 points would have taken a first prize at the second show without a shadow of a doubt.

Is this fair?

This is mitigated somewhat by issuing "score cards," yet it is much more satisfactory to obtain a prize.

I brought this matter before the Rt. Hon. the Minister of Agriculture, and I am pleased to say that he has decided to create an opportunity for awarding prizes to butter quite independent from any show committee.

These prizes consist of two diplomas, one "first class" for "excellent" butter or cheese scoring 91 to 100 points, the other is a "second class" diploma for "very good" butter or cheese scoring 80 to 90 points.

There are certain conditions, however, which have to be observed before the diplomas can be obtained. The judge doing the scoring must be approved of by the Minister of Agriculture. Then the scale as described in this bulletin must be applied.

As the number of judges for dairy produce is limited the diplomas will not be obtainable at every show in the Transvaal. But an opportunity will be given to every farmer to compete for it in the following manner:—

Four times every year (or more) butter can be sent to the Agricultural Department to compete for the diplomas on the following conditions:—

Only those may send butter who took a first or second prize at some Transvaal Agricultural Show or scored at least 80 points. The butter must be wrapped in parchment paper and full name and address of sender must be plainly written or printed on each wrapper, together with date of making.

Each sample to consist of two pats of at least 8 oz. and not more than 16 oz. each.

Each sample to be accompanied by a score card of a Transvaal Agricultural Show, showing a score of at least 80 points, or a similar document proving a prize was obtained.

Intending competitors must give notice of their desire to compete to the Minister of Agriculture, and will receive timely notice with full information how, when, and where to send the samples.

On the diplomas the score adjudged to these samples will be printed; therefore it is obvious that the diploma will be an official certificate of the quality of the butter. No special arrangements have been made yet for like competitions for cheese. But those who want their cheese judged can inform the Minister of Agriculture.

* * * *

Now, a few words about the scale to be applied. Some points are counted four times, others three times, or twice, according to their importance. The judging should be really done in adjectives, not in points, and the adjectives translated into points later. This is the best way to learn the handling of the scale. Afterwards the judge will be so well acquainted with the points that he leaves the adjectives out and gives points at once. It should be done somewhat in the following way:—

The first glance is sufficient to decide about "style and finish," say it is found not quite "very good," yet more than "good," somewhere midway, we would get then 3½, and as it counts twice, 7 points. Next the wrapper is taken off and the colour is examined. The "colour" must be even throughout and "true." This means it must be a normal butter colour, not turning towards the particular tone rancid or bad butter shows. This has nothing to do with the actual shade, which may vary from dead white to deep yellow. Say the colour is found excellent, this means 5 points, as colour counts once only. Next we cut the pat half through and break it off suddenly, at the time it breaks we smell it. Supposing the smell to be "very good," just a trifle better than that, we would give say 4¼ points, and as smell counts four times this gives 17 points. We examine the pat at the place where it is broken (not cut) to see the "grain." This should be very fine, with sharp edges, not rounded; we feel the pat and find out the "texture," which should be firm and solid, but somewhat toughish, not brittle. Now, if we see a large rounded grain and the butter is rather soft, it is evident the making was not right. The butter was either over-churned or over-worked.

Suppose in our sample case we find a small grain, somewhat rounded, very fair texture, but too soft, we could call it midway between "good" and "very good" at 3½ points, which, as it counts four times, gives 14 points.

Next comes the taste, and suppose this to be "very good" we get 4 times 4 = 16 points.

Last of all we test the "moisture" by rubbing the thumb nail along the pat to see if moisture comes out, and looking at the cut side for small drops. None should show.

* * * *

If this examination gives a satisfactory result, midway between very good and excellent, we accord 2 × 4½, i.e. 9 points. As a result of the first judgments our score looks as follows:—

Style and finish, good to very good	7
Colour, excellent	5
Grain and texture, good to very good	14
Taste, very good	16
Smell, very good	17
Moisture, very good to excellent	9
	68

Thus this butter has scored 68 points out of a possible 85. Fourteen days after the first judgment the butter is judged again on those items that can have varied in the meantime, and these are "colour," "taste," and "smell." Of course the butter has been kept in a cool and dark place.

The top score for keeping qualities is $3 \times 5 = 15$ points. I propose to accord these in the following manner:—

The number of points lost on "colour," "taste," and "smell" is deducted from 15 points, and the remaining points are accorded for keeping qualities.

Suppose at second judgment we give for:

Colour	5 points.
Taste	16 ,,
Smell	16 ,,
Total	37 points.

At first judgment we gave 38 points. One point has been lost. "Keeping qualities" score accordingly with $15 - 1 = 14$ points. Now we have got our final score, which looks as follows:—

	First Judgment	Second Judgment.
Style and finish	7	7
Colour	5	5
Grain and texture	14	14
Taste	16	16
Smell	17	16
Moisture	9	9
Keeping qualities	—	14
		81

As 80 to 90 points entitle to a second class diploma such a diploma for very good butter would be awarded in this case.

* * * *

The judging of the cheese is done very much in the same way as the judging of the butter, only the items for judgment are different and more numerous.

In cheese an "expert" will be able to estimate the keeping qualities at a first judgment, and a second judgment is not indispensable, as in the case of butter. If a second judgment is wanted the period between the two judgments would vary considerably, according to the variety of cheese. The scale described is simple enough, but the great point is to obtain a judge who feels certain of his adjectives and knows exactly when to limit himself to "good" and when to place "very good," etc. This cannot be learned from a description; it must be taught by practical experience.

Scale for Judging Butter and Cheese.

0	Very bad.
1	Bad.
2	Insufficient.
3	Good.
4	Very good.
5	Excellent.

Butter.

	Counts.	Top Score.
Style and finish	2 ×	10
Colour	1 ×	5
Grain and texture	4 ×	20
Taste	4 ×	20
Smell	4 ×	20
Moisture	2 ×	10
Keeping qualities	3 ×	15
Total	20 ×	100

Cheese.

	Counts.	Top Score.
Shape	1 ×	5
Colour	1 ×	5
Rind	1 ×	5
Consistency	1 ×	5
Taste	3 ×	15
Smell	2 ×	10
Curd	2 ×	10
Holes	2 ×	10
Salt	1 ×	5
Keeping qualities	2 ×	10
Fat	3 ×	15
Uniformity	1 ×	5
Total	20 ×	100

80 to 90 points scored = second class diploma for very good butter or cheese.

91 to 100 points scored = first class diploma for excellent butter or cheese.

For applying the full scale of 100 points for butter *two* judgings are required, with about 14 days' interval. The second time only "colour," "taste" and "smell" are considered. The points these three have lost are deducted from the 15 points for keeping qualities.

The Tobacco Section.

TOBACCO TRANSPLANTING AND FURTHER TREATMENT IN THE FIELD.

By J. van Leenhoff, Chief of Tobacco Division.

The best of care and attention having been bestowed upon the seed beds, and having, as the result, obtained strong, healthy, and green seedlings with well-developed root system (as explained in previous articles), the question of transplanting must be considered. In the Transvaal first transplanting is done during the month of October.

Size of Seedlings to be Transplanted.

The best size of seedlings to be transplanted is when they are from three to four inches above ground, and having from six to eight leaves. If transplanted when larger it will be found that, as there is a larger surface for evaporation, there is greater risk of them dying off, for the rootlets will require a day or two, or sometimes longer, before having taken root well.

Resetting of Missing Plants.

Dead plants can, of course, be replaced later on by fresh seedlings, but this prevents the production of a uniform crop, and, as I have already stated, the planter must do all in his power to procure as uniform a crop as possible.

Furthermore, it must not be forgotten that uniformity in ripeness will make it possible to harvest and cure the crop as nearly as possible at the same time, a more uniform quality in the finished leaf being thereby obtained. All these points tend to make the leaf of greater value.

Eliminating Bad Seedlings.

In order to save time and trouble afterwards, the best plan to adopt is to remove and destroy the weak and bad seedlings from the beds at an early date, i.e. those yellowish looking and long stemmed, also those damaged by insects or disease. If, however, proper care is bestowed upon the seed beds most of the young seedlings will be found to be healthy, and good transplanting material will be available.

Disease.—Preventives and Remedies.

If the following preventives and remedies for disease, etc., are applied, the risk of weak, unhealthy seedlings making their appearance will be greatly decreased:—

(*a*) The thorough preparation of the seed beds, and practically sterilize its soil.

(*b*) Thin and even sowing of the seed.

(c) Proper watering and shading, and by covering in the beds with cheese-cloth or a similar material to prevent moths of splitworms and such insects laying their eggs on the beds and on the seedlings. If the eggs are deposited on the latter there is, of course, always the probability that they will be transferred to the field when the seedlings are planted out.

The preventives and remedies for most of the diseases usually found in seed beds are as follows:—

(1) Sulphur and lime treatment for checking white rust or mildew.

(2) The application of bordeaux mixture as a fungicide.

(3) Paris green for eradicating the biting and sucking insects.

The proper method of applying these preventives and remedies has already been described in a previous article which has been published in bulletin form, and can be obtained on application to this office.

Pulling out Seedlings.

To facilitate the pulling of the young seedlings, to decrease the risk of damaging the leaves, and more especially the rootlets; the seed bed should be thoroughly soaked with water before this work is commenced.

If the seed has been thinly and evenly sown it will be found that transplanting can the more easily be done. I do not recommend that all the earth should be shaken and washed off from the roots of the seedlings, as is sometimes advised, for by the latter method the risk of damaging the rootlets is increased, whereas, by adopting the former method, the seedlings will take root the more easily and quickly when set out in the field.

When taking seedlings from the bed, use a pointed stick, and by running this under the rootlets and then giving it a twisting motion the soil around the plant is loosened, and by taking the latter by the tips of the top leaves it can be lifted from the soil with most of its roots intact. Do not take hold of a seedling by the growing bud, for by so doing you will bruise it.

Pack the seedlings carefully in a shallow basket provided with a handle (see Plate 18, Fig. 3a), and keep it covered, so that the young plants it contains are protected from the air and the sun. If the field is close at hand do not lift too many at the same time.

A little loose, damp earth sprinkled amongst the roots of the plants, and to slightly moisten and cover the tops, enables the seedling to withstand the exposure entailed by a longer journey. If this is done the plants could be transported some considerable distance. Good results may even be obtained if they are not set out until the following day, that is provided they had been properly packed.

Setting by Hand.

There are on the market at the present time some suitable implements for transplanting tobacco plants. When, however, the work is to be undertaken by hand, the following points should be observed.

One staff of workers should be kept constantly employed carefully pulling out the seedlings from the bed, and at the same time others should be continually engaged setting them out in the field, so that no time is lost.

The transplanting basket can be carried on the left arm, and the distribution of the plants can be easily managed. The plant setter is provided with a sharp-pointed stick about a foot long for making the holes in the ground. He puts the seedling into the hole he has made, and presses the soil around, so that the plant stands erect. The earth can be pressed around the plant by placing the stick in the ground close to the plant, and pressing the ground towards the latter, thus making a second hole. Another man, who is closely following the man with the seedlings, fills this second hole with water from a watering-can which he carries; he then covers the hole with earth to prevent evaporation. (Plate 18, Fig. 3*b*.)

Tobacco being a tap-rooted plant, in some instances sending its roots down to a depth of two feet or more, it is necessary that the tillage of the land destined to receive the young plants shall be deep.

On the growth and success of the plant a good deal depends upon its being set well and erect in the soil, and to this point, therefore, special attention should be paid. It is frequently found that the non-success of 80 per cent. of the plants which fail to make a good growth can be traced to a deformed taproot or to careless transplanting.

If the plants need irrigation after transplanting, water must be led in *between* the rows and *not* directly over the roots of the plants. It is unnecessary to dwell upon this matter, as it has frequently been fully discussed in previous articles.

If the sun is shining when the seedlings are transplanted, they should be provided with shade until they have taken root. A handful of grass or large leaves can be utilised for this purpose. On large tobacco plantations in other countries small pieces of plank, specially made, are used for shading the young plants when first set out in the field.

Whatever shade is provided, however, it must be removed as soon as possible, otherwise the shelter it affords will attract insects. Transplanting should, of course, be carried on on cloudy days or during light rains if this be possible. If no cloudy weather prevails, or if from other causes it is impossible to do this, then the best time to take the work in hand is late in the afternoon.

Transplanting by Means of a Machine.—The Transplanter.

In old-established tobacco-producing countries, where flat lands are available, and especially in those parts where labour is expensive and difficult to obtain, the transplanting of the tobacco plants is usually performed with the aid of a machine called the transplanter.

Plate 18, Fig. 3*c*, shows one of these machines at work. One of them is at our Rustenburg tobacco farm in use.

Required for its manipulation, in addition to the driver, are two persons who sit on the back and place the seedlings into a tube, from which they fall into a hole in the soil previously made by the

Fig. 1

Fig. 2

Plate 16

Fig. 1. A newly imported variety of tobacco showing uniformity of leaf.
Fig. 2. A model air-curing shed as erected at the Government Experiment Stations, Rustenburg and Barberton.

Fig. 1

Fig. 2.

Plate 17.

Fig. 1. Field of tobacco. Seed selection—Bagging of a seed head.
Fig. 2. Field of Boer tobacco showing a large number of plants bagged to secure uniformity.

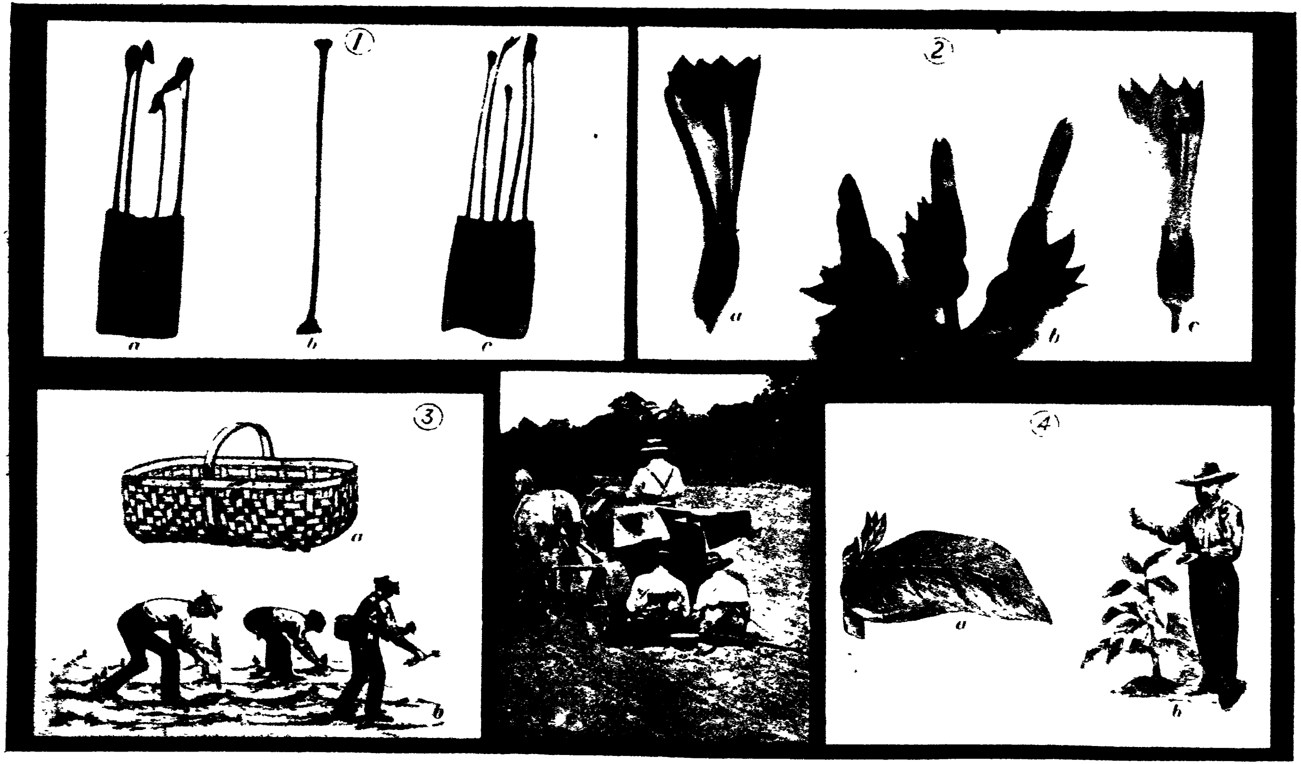


Plate 18.

Fig. 1.—(*a*) Anthers before bursting. (*b*) Pistil showing stigma, the enlargement at the apex. (*c*) Anthers after bursting.
Fig. 2.—(*a*) The flower has the anthers cut out, leaving the pistil in position exposed. (*b*) A flower head ready for bagging. (*c*) The pistil cut out, leaving the anthers in position exposed.
Fig. 3.—(*a*) Basket for carrying plants. (*b*) Setting plants by hand. (*c*) A tobacco transplanter at work.
Fig. 4.—(*a*) The sucker, to be removed. (*b*) Topping the plant.

machine. The machine performs all the necessary operations, the soil is pressed around the plants, and the latter is also watered from water carried in the barrel attached to the transplanter.

Distances between Plants in the Field.

It must always be borne in mind that, for the production of heavy tobaccos, the distances between plants in the field must be greater than for lighter leaf. For heavy tobaccos it should be, say 3 ft. x 3 ft. or even 4 ft. x 4 ft. Other important points are that heavy tobaccos should be topped low and harvested late.

In the production of light leaf just the reverse conditions must be applied, care being taken to see that sufficient space is left for passing between the rows and for cultivating the crop. For bright tobaccos it will probably be found best to plant, say, 3 ft. between rows, and 18 in. to 2 ft. between plants.

Cigar-filler and binder tobaccos will probably also do well at a distance of 3 ft. by 18 in.

For cigar-wrapper leaf, 3 ft. by 15 in. should be about the correct distance.

Treatment of Plants in the Field.

Cultivation.- The first cultivations can very easily be done with the aid of the horse or hand cultivator. I have already written much with regard to this subject in previous articles, and I need only say here that the main object is to keep the soil well pulverised and clean, and to prevent the baking of the ground around the plants.

Removing Lower and Diseased Leaves.--The lower, also any inferior leaves, must be removed from the stalk at an early date. This will provoke a larger circulation of air through the field, and the propagation of disease is thereby decreased. These leaves so removed should be burnt at once. It may be said that the removal of such leaves is a special safeguard against mildew and white rust.

If any other spotted or diseased-looking leaves appear, or if the plant itself becomes diseased, they should be immediately removed and burnt.

Spraying.—Bordeaux mixture as a preventive for fungus disease, and paris green as a remedy for biting and sucking insects, should be applied to the young plants shortly after transplanting, and afterwards at regular intervals of about a fortnight until topping time.

Chemicals should not be applied unless actually necessary after the plants have been topped, so that the poisons may be washed off the leaves by the rains before harvesting time arrives.

Topping.--The tobacco plant should be topped at a certain period of growth, i.e. when the bud appears. The nature of the plant being to reproduce itself, a flower bud appears, which, if left to grow, will branch out, flower, and eventually bear a large number of seed pods. If the plant is permitted to flower it destroys the value of the leaf, and decreases the weight of the harvested crop.

As soon as the flower bud appears and can be removed without injury to the young tender leaves at its base, it must be pinched out with the thumb and forefinger. (See Plate 18, Figs. 4 *a*, *b*.) (In France the tobacco planters allow the thumb-nail to grow long specially for performing this operation easily and well.)

For heavy tobaccos, the plant must be topped low, as soon as there are indications of the bud appearing. From eight to twelve of the best leaves are left, according to the development of the plant. A weak plant naturally cannot mature as many leaves as a strong plant.

In the production of bright tobaccos also the topping must be done rather low, though care must be taken not to produce coarse leaves, and therefore a larger number of leaves must be left on each plant than in the case of heavy tobaccos. The number of leaves left vary from about 16 to 22, according to the condition of the plant and the variety of tobacco planted.

For cigar-wrapper tobacco, however, the topping must be done rather high in order to produce light, silky leaves.

The removal of the flower bud creates a diseased or abnormal condition in the plant, and this condition, artificially produced, governs the whole of the curing and fermenting processes after the leaf has been harvested.

Leaves of plants which have been permitted to flower or to produce seed can neither be properly cured nor fermented, the product being woody and worthless. In fact, unless the topping and suckering is rigidly and properly carried out, the crop reaped is not tobacco.

The quality of the finished leaf to be placed on the market depends very largely on this manipulation.

When topping, each plant must be judged according to its ability to mature the number of leaves left upon it, and this must be determined by the vigour of the plant and the purpose for which the tobacco is grown. If too many leaves are left it makes the leaf thin and lifeless, whilst if too small a number are allowed to remain on the stalk this will result in the leaf being too coarse.

Suckering.—The terminal flower bud having been removed, the plant will produce lateral branches from the axils of the upper leaves. In time these must be removed, but without injury to the leaves.

The removal of the suckers throws the strength of the plant into the leaves. But there is a tendency, through having topped the plants too low, or through changeable climatic conditions, for the leaves to become too thick. This may be counteracted by leaving one top sucker on the plant.

Experience has taught me that, instead of breaking off the suckers in the axil, it is better to leave a small portion of the stem of the sucker--about 1 inch in length. By so doing, less suckers will appear.

Harvesting and Curing.--The harvesting and curing of the tobacco crop are subjects which have already been discussed in previous articles, and will probably be dealt with further at some future date

For the benefit, however, of planters who propose making some alterations in their tobacco sheds, and for others who anticipate the erection of such sheds, I am inserting in this article a plate (Plate 16) showing a model air-curing shed erected on our experiment stations at Rustenburg and Barberton.

Model of Air-Curing Shed.--The shed is divided into two portions, on the one side for dealing with cigar and other leaf which has been harvested leaf by leaf, and the other for dealing with tobacco harvested

by the whole plant. This shed is not to be used for curing bright tobaccos.

The matter of curing the tobacco crop has been fully dealt with in an article which appeared in the *Agricultural Journal* No. 17, October, 1906, and in a bulletin on "The Production and Curing of Bright Tobaccos," for which apply to the Government Printer, Pretoria.

THE BREEDING AND SELECTION OF TOBACCO.

By J. van Leenhoff, Chief of the Tobacco Division.

In the Transvaal, until quite recently, the only object has been to produce a pipe tobacco for local consumption. Consequently, sufficient trouble has not been taken to produce either a good yield per acre or tobacco of a quality for which there is a good demand in South Africa and oversea.

The pipe smoker of the old population is quite satisfied with the article which has supplied the market for years past. But the new population who have migrated to the Transvaal from other countries, and the townspeople in general, in fact all those accustomed to the European manufactured product, still demand either imported tobaccos or those classes grown in the Transvaal which closely resemble the imported product.

In view of this fact, one of the main objects of Transvaal planters must be to imitate these imported tobaccos as far as possible so as to supply the demand of the South African market, and as a result of this move we shall be the better able to supply an article for export when we have learnt the application of better methods, and consequently decreased the cost of production. It must be admitted by all that the market demands are well defined and classified according to the character and quality of the manufactured product. The value of a tobacco crop depends upon the ability of the grower to produce a type closely conforming to the market standard for each particular grade. New types must be developed which not only more closely resemble the imported varieties, but which also possess the desirable qualities of the latter. This can be done by adopting (*a*) special methods in the field and in curing, and (*b*) the sowing of the proper seed.

. . . .

It is with special regard to tobacco seed that I wish to offer to tobacco planters some practical suggestions for the improvement of their crops by selection and breeding, and to explain the manner how to do with the tobacco seed samples I have been distributing to the tobacco growers throughout the country. The seed issued from this office represent (*a*) imported, (*b*) acclimatised, (*c*) specially selected varieties from our own experiment stations. I may say that many of the planters have written expressing their appreciation of the results obtained with this seed, and they have at the same time furnished interesting data regarding the experiments which they have conducted.

Tobacco plants raised from newly imported seed generally develop many different types, some of which may be valuable, but at the same time most of them are irregular and undesirable.

When introducing new seed into a locality it should first be thoroughly tested before it is sown on a large scale, and this applies more especially to seed imported from oversea.

The irregular characteristics shown when new seed is sown is chiefly due to the change in climatic conditions, and to the nature of the soil. The tobacco plant is, in such a marked degree, influenced by these changes in climate and soil, so that the necessity for selection has become a matter of the first importance.

When walking through a Transvaal tobacco field, one at once notices the irregularities of type, and, on closer observation, it will be found that practically no two plants are exactly alike. They will differ, either in size, shape or texture; in the position or distance of the leaves, etc. In some cases it will be found that certain plants have been destroyed by disease or damaged by insects, whilst others have not been attacked. In short, one seldom finds many plants to come up to the ideal of the planter. A few such ideal plants may, however, be found amongst the crop, and by a glance at these it will be readily understood that immense benefit would result to the planter if the whole of his crop conformed to the type of the ideal plant. Yield per acre and percentage of good leaf would mean an enormous increase of profit.

It has been proved in other countries, and also on our tobacco experiment stations here during the last two years, that seed selection pays. *The seed should be selected from bagged plants of the finest type only; from the main terminal flower cluster; from the largest and strongest capsules after having taken off the smaller and weaker capsules, leaving only about fifty to sixty on the crown stalk; and, finally, the heaviest seed must be selected.*

The use of good seed is, needless to say, one of the most important questions in tobacco culture. Seed must not be taken from the second growth (i.e. from the sucker crop after the tobacco has been harvested). It must not be taken from all kinds of plants in the field, but only from the very best. Seed must not be collected before it is ripe, which is indicated by the dark brown colour of the capsules.

It may be confidently stated that no general farm crop responds so readily to selection and breeding as does the tobacco crop. The transmitting power of the individual parent plant is exceedingly strong, and the progeny of these plants show remarkable uniformity when the best seed is bagged* and saved on the lines set forth later on in this article.

It must be remembered that the production of uniform types of established varieties can only be secured by using the seed of self-fertilising plants.

As a single plant produces a very large quantity of seed, it is clear that by reserving only a few plants possessing the best characteristics, a sufficient quantity of highly bred seed can be obtained for a large area.

* "Bagged."—A paper bag placed over the seed head to prevent cross-fertilisation.

When sowing new tobacco seed it is advisable that only a small number of plants be grown the first year in order to test the suitability of the particular strain to local conditions. Afterwards, from this small plot, the grower can select the best individual plants for seed for his entire crop of the following season.

Much has been written on tobacco breeding, and it is almost impossible to refer to the subject without mentioning the name of Professor A. D. Shamel, of the United States Department of Agriculture, an authority on tobacco breeding to whom I am indebted for much information of the greatest value.

. . . .

Most plants require the union of the male and female to produce seed, very much in the same manner as animals, and with similar results in so far as hereditary characteristics are concerned. We could divide the large class of Angiosperms or flowering plants, to which tobacco belongs, into the following groups, i.e. those possessing (*a*) male and female on separate plants, such as hemp; (*b*) male and female in separate flowers on the same plant, such as maize; and (*c*) male and female in the same flower, tobacco.

The tobacco plant, having both male and female in the same flower, the flower will specially interest us.

One of the simplest and most practical descriptions of the tobacco flower I find has been written by Mr. W. H. Scherffius, one of Professor Shamel's assistants, who expresses himself very simply and clearly, and in a manner easily to be understood by tobacco planters. I therefore prefer making use of his description of the tobacco flower.

The flower consists of four principal parts, viz.:—

(1) Calyx.
(2) Corolla.
(3) Stamens.
(4) Pistil.

The *calyx* (1) is the green covering over the ovary and base of the corolla, and is about one-third the length of the corolla. It serves as a covering which is probably some protection to the ovary during its development into a seed pod.

The *corolla* (2) is a tubular envelope about two inches long, which serves as a protection to the essential organs, the stamens and pistil (i.e. the five males and one female).

The *stamens* (3) are usually five in number, which form a circle around the pistil. Each stamen is composed of a filament or stalk, which is attached to the inner surface near the base of the corolla, and a small organ somewhat the shape of a grain of wheat at the apex of the filament (see Plate 18, Figs. 1 *a*, *c*) which is the anther, and represents the male side of the tobacco plant. The fertilization is accomplished by the anthers dehiscencing, or opening, and discharging the fine, dust-like substance called pollen on the crown of the female part, the pistil. This starts a growth which goes down the stem of the pistil to the enlargement at the base, and sets the seed pod.

The *pistil* (4) consists of the stigma, style, and ovary. The stigma is the enlargement at the apex of the pistil, the surface of which is moist, rendering it receptive and retentive for the grains

of pollen which fall on it and start the growth which fertilises the ovules in the ovary.

The style is the stem connecting the stigma and ovary. The ovary is the enlargement at the base of the pistil, which contains the ovules or rudimentary seed.

Plate 18, Fig. 2 *a*, shows a flower which has been opened and the stamens cut out to expose the pistil; *c* shows a flower which has been opened and the pistil taken out, showing the anthers in position. Though these organs are small, with the aid of a magnifying glass one can see a difference in the appearance of the anthers before and after dehiscence.

. . . .

Tobacco is more highly specialised, and is grown under a more intensive system of cultivation than any other general farm crop. It is a well-known fact that the tobacco plant is exceedingly sensitive, and responds more readily to soil and climatic conditions.

Therefore the tobacco planter should select his own seed. The character of the soil in any region varies to such an extent that every farm presents a different set of conditions peculiar to the locality, and it is therefore important that the planter should select his tobacco seed on his own farm.

After a variety has been adapted to the grower's conditions of soil and climate, the yield and quality of the crop can always be improved by the selection of the most desirable plants in the field for seed production. In buying seed the grower has no evidence from the seed itself as to the nature or quality of the plants which it will produce, and is liable to lose a crop owing to the use of undesirable seed.

The careful selection and improvement of the type by the grower not only increases the yield and quality of his crop, but the reputation thereby acquired insures a high price and a ready market for such tobacco.

Methods of Selection.

The first step in the selection of tobacco is a careful study of the individual plants in the fields from which the selections are to be made before any plants are topped.

It is of the greatest possible importance that the grower have a clear and well defined ideal of a perfect plant best adapted for the purpose for which his crop is grown, and that the individual plants selected for seed conform as nearly as possible to the ideal type. The tobacco plant is naturally self-fertile, but is frequently cross-pollinated by insects or other agencies carrying the pollen from one plant to another. The variation in types and individual plants within the variety may for the most part be attributed to cross-fertilization, and uniform types and plants can only be secured by preventing this crossing.

Saving Seed under Bag.

A simple and effective means of protecting the tobacco flowers from the injurious effect of cross-fertilization is by covering the inflorescence with a paper bag—a 12 lb. grocery bag is the most suitable size—before the flowers are ready for fertilization. (See Plate 17.)

This bag should be of light, but strong, durable paper, which will not injure the plant or flowers by bending the plant out of its natural position, and at the same time will not be easily torn or destroyed by the rain or wind. The centre cluster of flowers in the seed-head should be used for seed production, and all suckers or other seed-bearing branches removed before the bag is applied. It is a good plan to remove two or three top leaves and suckers, just below the flower-head, and the mouth of the bag should be tied around the stalk, but not in such a manner as to injure the plant or to interfere with its growth.

The plants should be bagged before the earliest flowers begin to open and the bag moved up the stem every three or four days as the plant increases in height in order to allow sufficient space for the development of the seed-head, and at the same time any weak or small capsules should be cut off, leaving only 50 or 60 good capsules, this giving the ones which are left increased vigour. When the seed pods have turned dark brown, the entire top of the plant should be cut off and the leaves removed. The bag should be opened, and all of the small and late pods picked off, and only the large, heavy, and well-developed seed pods should be allowed to remain. The bag should then be replaced, and the seed hung up in a dry place, such as the attic of a house, until the seed pods are thoroughly dry. After this they should be cut off from the stem and the seed shelled out.

The Agricultural Section.

THE CAMPBELL SYSTEM OF DRY LAND FARMING.

By William Macdonald, M.S.Agr., Dry-Land Agronomist.

The most important advance in recent agricultural science has unquestionably been the sudden rise in popular favour of what is now known as the Campbell system of scientific soil culture or, as it is more commonly termed, the Campbell method of dry farming*; and there is but little doubt that this practice, in some form or another, is destined to play a large part in the reclamation and settlement of the arid lands of the British Empire, as it has already done in the Western States of America. In all lands subject to long periods of drought the conservation of soil moisture becomes a serious problem in farm practice; and, so far as our own Colony is concerned, it is not too much to say that the agricultural prosperity of the Transvaal mainly depends upon the ability of the farmer to make the most of his rather scanty and irregular rainfall.

The credit of being the first to emphasize the essential need of preserving the soil moisture of the western prairies of America by proper methods of tillage assuredly belongs to Mr. Hardy W. Campbell, of the town of Lincoln, in the State of Nebraska. This pioneer dry land farmer was born in the East, in that little wedge-like State of Vermont driven in between New York and New Hampshire; and we may assume that his forebears were more familiar with the sodden moors of Argyll than with the sun-scorched plains of Kansas and Nebraska.

In the year 1879 Mr. Campbell migrated from New England and settled in what was then known as the Territory of Dakota—since divided into the two States of North and South Dakota. His agricultural career was not startling, merely the hard, grim, struggle of the prairie farmer; wheat growing year in and year out; alternate failure and success, and always the fear of drought, the blizzard, rust, hail, and frost. At that time it was widely stated that the common failure of the wheat crop was due to the exhaustion of the fertility of the soil by the heavy crops of the first few years, and, further, that these lands would never yield large crops again. Mr. Campbell was convinced that this was a false notion, and that the true explanation—the key to the problem—would be found in a better and a more scientific system of soil culture.

His wide and varied reading confirmed this belief. He noted that Jethro Tull had seen crops growing successfully in both Italy

* The term "Dry Farming," or, as the writer prefers to use it, "Dry Land Farming," is a new term which has been introduced from Western America; but since it meets a real need it will doubtless find a permanent place in agricultural literature. It may be defined as the conservation of soil moisture during long periods of drought by means of tillage.

and France on land that had been under cultivation for a number of years; and that Tull himself had grown thirteen unmanured wheat crops without intermission and without decrease in yield, on the self-same field by means of systematic tillage. But it was not until the year 1892 that any definite results were won. This was a period of great activity in the study of the soil, and Mr. Campbell was able to make use of the investigations of Hilgard of California, of King and Goff of Wisconsin, and of the illuminating writings of Roberts and Bailey of Cornell—all of which he most carefully studied. In passing, it may be mentioned that the writer of this paper had occasion to study what was then called "the Campbell method of cultivation" on the State Experimental Farm of South-Western Minnesota, as far back as eleven years ago. It is therefore plain that although it has lately acquired a world-wide notoriety the system has been in vogue for a considerable time.

The invention of the Campbell sub-surface packer may be traced to a simple observation. In very dry seasons Mr. Campbell perceived that the growth of the grain was always better and thriftier in certain places; as, for example, where the soil was compacted when a horse stepped over the ploughed field leaving the impress of its hoof-prints on land which was afterwards sown to wheat; or, perchance, where the wheel of a heavy farm wagon had rolled over the furrow-slice, there the growth of the grain was always taller, darker, healthier in colour, wide-leaved, giving a greater stooling and larger heads. This was the first great principle, namely, that the soil in the lower part of the furrow had been made firm and fine—in a word, compacted. But Mr. Campbell also noted that wherever the horse had lifted his foot a little loose earth was left behind; just as, in like manner, the rolling of the wagon wheel let fall a little loose soil. Here was the second great principle, namely, the formation of the "soil" or "earth mulch." Thus the purpose of the Campbell sub-surface packer was simply to imitate the horse-foot track in the entire field by firming the lower part of the furrow-slice and leaving the top portion loose to form a soil mulch. The effect of sub-surface packing, therefore, is to draw the moisture from the deeper strata below, just as is the case with the ordinary roller; but, further, and most important, to check the evaporation of the moisture from the surface by the formation of an earth blanket or soil mulch. This upward passage of water brought about by sub-surface packing is of the highest importance in the long dry periods so common in Western America and South Africa.

Mr. Campbell writes: "When we reach a point in the extreme heated portion of the last afternoon prior to a heavy rain, when our supply of moisture is beginning to shorten, the fact that we have by this sub-surface packing been able to lift the water stored below a little faster may be the means of doubling or trebling the yield."

In a word the proper use of the sub-surface packer puts the soil into a firm and mellow state, whilst the harrow forms a fine loose mulch of some two or more inches deep, and the drill sets the seed

in a fine, firm, moist, mellow bed—an ideal place for rapid and vigorous sprouting.

According to Mr. Campbell, any one who breaks prairie lands and plants them without first devoting a full season to careful cultivation in order to get the soil in the proper physical condition for the promotion of plant growth, and also to store a sufficient amount of moisture within reach of the plant roots to carry the growing crop through a protracted drought is simply inviting failure should a season of unusual dryness follow.

Summing up, it may be said that sub-surface packing or the fine firm fitting of the lower portion of the furrow-slice results in three things:—(1) The water-holding capacity—or soil reservoir—where the main roots grow is enlarged; (2) the movement of the moisture from the lower and deeper soil layers to the roots of the plants is quickened; (3) the area of the feeding roots is greatly extended. These three factors usually result in carrying a crop successfully through a long, hot, dry period; whereas a crop grown under the ordinary methods would be seriously stunted in growth if, indeed, it survived at all.

More important, however, than the invention of the sub-surface packer is the method advocated by Mr. Campbell for the conservation of soil moisture over a period of from six months to one year, and what he terms "Summer Culture."* This work was first begun in Western Kansas with an average annual rainfall of under 20 inches; it has also been successfully used in Utah with a rainfall as low as 10 to 15 inches per annum. The rainfall in the Transvaal for the season 1907-08 varied between 16 inches at Bloemhof to 53 inches in the Woodbush Forest.

The following is a description of summer culture as practised in the Western United States, and it will be seen that this system could readily be carried out in the Transvaal with certain local modifications due to the differences in our seasons and soils. In the springtime of America, as soon as the frost is well out of the ground, land that has already been ploughed is gone over twice with a disc harrow. This produces a mulch which prevents evaporation; it also opens and loosens the surface, so that the rains quickly percolate into the soil. The land is then harrowed after each rain with an ordinary harrow. If the rain is so heavy as to pack the surface of the soil, the disc harrow must again be used. Naturally, the kind of tool for each subsequent cultivation will depend upon the state of the land, the rainfall, and the weed growth. But, *since the main object is to store water in the soil*, two things must be constantly kept in mind, first, to prevent the surface of the soil from forming a hard crust, and, secondly, to prevent the growth of weeds. This tillage may continue for a matter of two or three months.

Then at the beginning of the rainy season comes the ploughing, which is done to a depth of 7 or 8 inches—the deeper the better.

*This name is rather vague; Summer tillage and summer tilled are better terms.

If the above plan has been properly followed out the soil will be moist and easily pulverised by the plough. Furthermore, the surface having been made fine, there are no clods to turn to the bottom of the furrow. If you have a sub-surface packer it should be used while the soil is still moist, making the lower half of the furrow fine and firm. Next, follow with an Acme or a common harrow which will form a mellow moisture-saving mulch. From this time on, the field must be cultivated after every rain and often enough to prevent any weeds from growing. It is then seeded to winter wheat or left over for the following spring crop.

It will thus be seen that two decided benefits accrue from Mr. Campbell's method of summer tillage: (1) The storage of the rainfall of practically one entire season. Experiments have shown that with the loam soil and clay sub-soils of the western prairies but little moisture is lost by percolation. (2) By maintaining a loose mulch on the surface and so preserving the moisture underneath and by allowing the sunshine and air to permeate into the ground the activity of the beneficial soil-germs is encouraged.

Regarding the possibilities of summer culture in semi-arid States, Mr. Campbell writes:—

"It is our opinion, based on practical results and observation of conditions similar to those in Western Kansas, that by the summer culture plan, storing the water the entire season and raising crops the following year, much larger average crops may be grown than the present average in Iowa or Illinois. In fact, we do not believe we overdraw when we say that in the more arid portion of the semi-arid belt by the summer culture plan, only cropping every other year, we can raise more wheat at less cost in ten years than can be grown in the more humid portions of the belt in ten consecutive crops by the ordinary plan. By our method we have the advantage of only seeding half the land. The great value of work along this line lies in grasping fully the idea of storing and conserving the rain waters, and studying carefully the necessary physical condition of the soil and endeavouring to bring it to the highest degree of perfection."

Mr. A. M. Ten Eyck, Professor of Agronomy of the Kansas State Experiment Farm, puts the whole matter concisely as follows:—

"The principle of loosening the surface of the soil and keeping a mulch of mellow soil in order to prevent the evaporation of the moisture is well recognised by farmers generally, and is practised to a greater or less extent in the cultivation of all kinds of crops. In the Campbell system of culture the purpose is to keep a mellow soil mulch on the surface of the land all the time, not only during the growing of the crop, but in the intervals between harvest and seeding time. Thus, after the crop is planted, the land is kept cultivated with the harrow or weeder in order to break the surface crust and conserve the soil moisture, and, following out the same principle, the harrowing or work with the weeder is continued after the grain or corn (mealies) is up, and during the growing period frequent cultivation is practised. After the crop is harvested the cultivation is not discontinued, but the surface of the ground is loosened as soon

as possible after the crop is removed by the use of the disc harrow, and thus the soil is kept continually in a condition not only to prevent the loss of the water already stored in the soil, but this same condition and mellow surface favours the absorption of rain and largely prevents the loss of water by surface drainage."

Summer culture is, therefore, different from summer fallowing, for the sole aim of the first is to keep the land constantly stirred to conserve the rainfall, whereas the object of the latter is simply to rest the ground by letting it lie idle.

Furthermore, the old idea of allowing the weeds to grow in order to be turned under for green manure, as commonly practised by the summer fallow system, is condemned by Mr. Campbell, who lays special stress on clean and continuous tillage for the conservation of moisture. His experiments clearly show the marked difference in yield between ground that has been summer tilled and land which has had its soil moisture sapped to such a degree by growing weeds that it breaks up on ploughing into a lumpy condition, and cannot be made into a moist, mellow, seed bed.

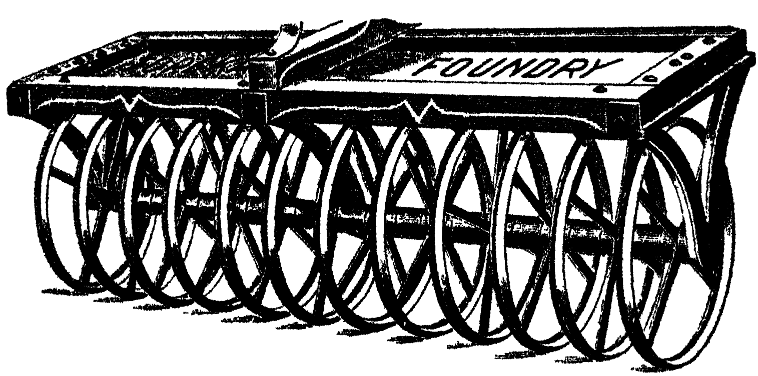
In the Transvaal, where much of our land is lacking in humus (decaying vegetable mold), the turning in of weeds has often a most beneficial effect, but, at the same time, these weeds absorb a large amount of soil moisture during their growth. Again, the Government Botanist, Mr. J. Burtt-Davy, in the pages of this *Journal*, has frequently emphasized the value of green manures in the building up of impoverished soils. Thus while, in dry land farming, our main aim is to preserve the soil moisture, we must never forget that the measure of our success will largely depend upon the initial tilth of our land. That is to say we would, naturally, expect better results from a soil well filled with humus than from light loose land wanting in vegetable matter, since the former soil will retain moisture for a much longer period than the latter.

It is true that the Campbell system involves much labour, nevertheless, the more closely it is followed the more certain will be the final crop. But it is not essential to purchase extra machinery in order to successfully practise summer tillage, although the more complete the farmer's equipment the better should be his harvest. The only new implement to South Africa is the sub-surface packer; and it would be easy to mention quite a number of farmers in the Transvaal who have obtained most satisfactory results on their dry lands simply by good deep ploughing and the intelligent use of what Virgil so aptly terms the "diligent harrow."

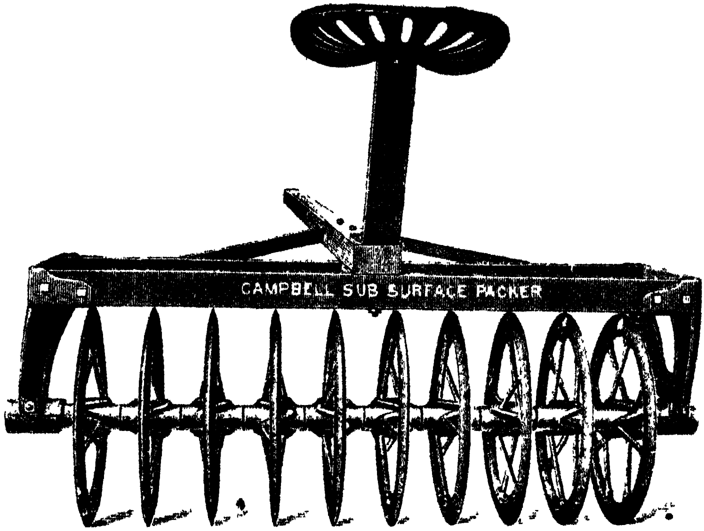
Mr. Campbell lays emphasis on the need of local experience. He says: "The mistake of the pioneer settlers was that they tried to farm in the West as they had done in the East, and the result was disastrous failure." But he also insists on the value of learning. "The ideal farmer is first of all a student, then an investigator, and, finally, a specialist; ever alert for new things and new ideas, open-minded and free from conceit; a man familiar with what is going on around him, and yet intensely devoted to his own work."

That the Campbell method is likely to stand the test of time there can be no reasonable doubt, since it is based on certain fundamental principles of farm practice, which both experience and experiment have shown to be correct. Moreover, it can never become merely a fashionable agricultural fad, for it demands a high degree of manual skill, and hard and continuous toil. Such a system is not likely to attract the rural dilettante or the lazy farmer. But for all those men who would enroll themselves under the banner of "better tillage" the most stubborn soil will be forced to yield a richer and a surer harvest.

Finally, it may be asked to what extent has the Campbell method influenced the agricultural industry of America. The answer is plain. The Americans are a practical people, and the mere fact that the great railroad companies and their land agents have enthusiastically endorsed this system is not without significance. It may be said that such companies are purely commercial concerns whose sole aim is to induce settlers to buy up land along their route. But in this day of keen competition even railroad companies cannot afford to embark in enterprises which are foredoomed to failure. They seek rather to establish thriving settlements which will result in large freight and passenger traffic. And further, the Arid Experimental Farms which have recently been established by the State and Federal Governments may be traced to the direct influence of Mr. Campbell's work; as well as the Dry Farming Congress, which meets once a year, and is composed of practical farmers and Government experts, who discuss the different problems which may arise from time to time. But beyond all those larger efforts which must make for vast and rapid agricultural development this new doctrine has brought fresh hope to the lonely pioneers of all lands who are engaged in the conquest of the desert.*



* Farmers will be pleased to learn that the Minister of Agriculture has decided to institute a series of experiments in dry land farming; and the writer of this paper will be glad to give any further information on this subject to all those who may wish to apply the Campbell System of Dry Land Farming on their own farms.



THE CAMPBELL SUB-SURFACE PACKER.

This implement is designed to pack the sub-surface soil or root-bed for the purpose of increasing the water-holding capacity of the soil, promoting the upward flow of moisture, and, consequently, developing a larger root system. It should be specially noted that the sub-surface soil, not the surface soil, is packed; thus the surface soil is left loose and mellow and forms an earth blanket or soil mulch which retards evaporation. This process of packing aids crops in withstanding long periods of drought. The machine consists of a series of V-shaped wheels 18 to 24 inches in diameter, the rims being 1 inch thick at the inner part, bevelled 2½ inches to a sharp outer edge, and placed on a shaft 5 to 8 inches apart. The effect is a lateral and a downward pressure firmly packing the lower part of the soil. Weights can be placed upon the platform to pack to the desired depth.

THE PRINCIPLES OF COOKERY.

BY JEANETTE C. VAN DUYN.

FOOD being the mainspring of life, all that relates to its proper preparation should be considered of the highest importance. The continual waste that is going on in our bodies must, by some means or other, be repaired; whilst something must also be done to give us the strength necessary for executing the work which each individual has to do. These purposes are served by the eating and digestion of food, and as cookery is the preparatory help to digestion of food, and as many of the foods consumed, especially those belonging to the vegetable kingdom, are indigestible without such cooking, the duties of the cook are the most important in the household, as upon her rest the welfare and health of the whole family. A well-nourished person is capable of performing far better work, mentally or bodily, and is not so liable to disease; for it is a well-known fact that infectious complaints spread most quickly amongst the ill-fed. The quantity and even quality of our foods are but secondary considerations compared to their cooking.

Foods must be prepared in a manner to be relished, while it must also be remembered, in preparing food, to combine all necessary items in the right proportion. Some foods are deficient in one respect, some superabundant in another; a little addition here and there helps digestion and supplies the body with what it needs. All cooks do this in obedience to the natural promptings of the appetite, but excellence in the art of cookery, as in all other things, is only attainable by practice, experience, and personal skill. No better motto for a cook can be found than to "make the best of everything," and that is where the science and art of cookery come in. A good cook wastes nothing, that is to say, nothing that can be turned to good account. The cooking of food should not be hurried; the proper amount of time must be allowed for the preparation of all meals. Food should be cooked just long enough and no longer, for over-cooking is as bad as under-cooking.

Again, the pleasures of the table have been appreciated in all ages, for they are those that we taste the oftenest and, therefore, refinement in cookery is by no means an improper object to strive to attain. It should be our aim to bring culture into our kitchens, and to make our girls proud of being able to cook.

A point also to be paid special attention to in cookery is to avoid monotony. It is well known that whatever is in itself very pleasant to the taste when taken occasionally becomes distasteful when consumed constantly for a length of time. Tasteless food is not only unpleasant, but also materially affects our health, for, unless relished, food cannot have its proper nourishing effect. As variety, however, can be obtained by various methods of cooking, this can easily be avoided, inasmuch as new dishes can daily be added to our list.

Last, but not least, I would like to touch upon the setting of the table and the serving up of meals, which undoubtedly call for far more attention. As a rule, too much carelessness is displayed in the appearance of the table, as well as carelessness in serving the homely everyday meal. It is very desirable that the table should have a fresh bright look, and should never lack some decoration of foliage or flowers. Flowers are one of the great items in making our tables look attractive, and we should therefore, not count the time lost that is spent in the care and culture of them, the more so as they amply reward us in the added air of cheerfulness and refinement they give to our homes. Further, the knives and forks should always look bright, the silver well polished, the glass sparkling and clear, and the tablecloth perfectly clean.

Finally, no matter how plain the food may be, pains should always be taken to serve it in such a way that it will sharpen and tempt the appetite. Indeed, the way of almost throwing the dishes upon the table is to be deprecated; whilst the custom—also too prevalent—of using cold plates should be discouraged, as it is the means of often spoiling the keenest appetite; the sight of congealed fat cannot be regarded as specially enticing. If it is considered how much warm plates—especially in winter—add to the enjoyment of a meal, this little care should not be looked upon as giving too much trouble.

RECIPES FOR THE FARM HOME.

A Nice Breakfast Dish.

Chop fine any little pieces of beef-steak or roast meat, add bread crumbs in the proportion of 1 tablespoonful to a coffee cup of meat. Season with pepper and salt, moisten with one egg and a little milk. Butter small patty pans and fill them two-thirds full. Bake until they are browned. Then break an egg over each one and cook from 3 to 5 minutes. Remove from the pans carefully that they may retain their shape.

* * * *

Stewed Cheese.

Ingredients: 2 onions, 1 oz. of butter, 3 ozs. of grated cheese, and buttered toast.

Boil the onions until soft, then chop them finely. Melt the butter, stir in the chopped onions and the cheese. Season highly and serve very hot on small rounds of buttered toast.

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Kedgeree.

Ingredients: ½ lb. boiled fish, ¼ lb. rice, 2 eggs, 2 ozs. butter, cayenne pepper, salt, and nutmeg.

Wash and boil the rice; boil the eggs very hard; break the fish in pieces, and carefully remove all the bones. Shell the eggs and cut the whites into small square pieces. When the rice is done, melt the butter in a stewpan, and add the rice to it. Then add the fish, white of egg, cayenne pepper, a little grated nutmeg, and salt. Mix them well together, serve piled up on a hot dish, sprinkle the grated yolks of eggs over it, and garnish with parsley.

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Patties from Cold Beef.

Ingredients: Some cold roast beef, 1 onion, ½ lb. flour, 3 ozs. dripping, ½ teaspoonful baking powder, salt, and pepper.

Mince the meat finely, also the onion, and season well with pepper and salt, and use any gravy at hand to moisten the mixture. Put the flour into a basin, rub the dripping into it, add baking powder, and sufficient water to make it into a stiff paste. Flour a board, and roll the paste out about a quarter of an inch thick. Cut it out into round pieces with a saucepan lid or a cutter; place a little of the mixture in the centre of each and fold the pastry over the meat. Place on a baking sheet, brush over with a beaten egg, and bake for about half an hour.

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Ham Rolls.

Put any small pieces of ham through a machine and moisten with a little butter (melted). Season with pepper and chopped parsley. Make a pancake mixture, pour sufficient in a pan to make a very thin pancake, fry only on one side, and turn out on to a plate, fried side up; leave till cold, then spread ham mixture over and roll up rather tightly. Cut into lengths of 2 inches, and fry in boiling fat until brown. They are nice and light and make a very pretty luncheon dish garnished with tufts of parsley and pieces of beetroot.

A Toast Dish.

Ingredients: 3 hard-boiled eggs, 1 tablespoonful each of butter and flour, 1 cup milk, ½ teaspoonful salt, a little pepper, and 5 slices of toast.

Make a thin sauce with butter, flour, milk, and seasonings. Separate the yolks from the whites of eggs, chop the whites finely, and add them to the sauce. Cut the slices of toast in two, arrange them on a platter and pour sauce over them. Grate the yolks and sprinkle over the top. Garnish with parsley. This is a delicious dish.

Tomatoes Stuffed with Sardines.

Choose large, firm tomatoes, not over-ripe; pour boiling water over them to loosen the skins, and take out the centre of each tomato with a small spoon. Remove the skins and bones from sardines; mash with the back of a fork; season with a pinch of cayenne, a little vinegar, and mix in a little chopped vegetable or flavouring herb if liked. Fill the tomatoes with the mixture, place a tiny sprig of parsley on the top of each, and serve on lettuce.

Potato Salad.

Chop cold potatoes into dice and add a little chopped onion. Make a dressing of 2 eggs, ½ teaspoonful of sugar, 1 teaspoonful salt, 1 teaspoonful mustard, and 4 tablespoonfuls vinegar. Boil until thick, and, when cold, pour over the potatoes.

Madeira Cake.

Ingredients: 6 ozs. butter, 6 ozs. castor sugar, 3 eggs, 10 ozs. flour, 1 teacupful milk, and 1 teaspoonful baking powder.

Beat the butter and sugar to a cream; add flour by degrees, and mix well together. Add eggs (well beaten up), milk, and baking powder. When all the ingredients have been well mixed together, flavour with a few drops of essence of vanilla or lemon, whichever is preferred. Bake in a moderately hot oven.

Marble Cake.

Ingredients of White Part: 2 teacups of flour, 1½ cups sugar, ½ cup butter, ½ cup sweet milk, whites of 4 eggs, ½ teaspoonful cream of tartar, ¼ teaspoonful soda, and few drops of essence.

Ingredients of Dark Part: 3½ cups flour, 1 cup sugar, ½ cup butter, ½ cup golden syrup, ½ cup milk, 4 yolks of eggs and white of one, ½ teaspoonful soda, ½ teaspoonful cream of tartar, and ½ teaspoonful mixed spice.

Mix these separately, and drop alternately into mould. Bake 2 hours.

RUSKS.

Ingredients: 3½ lbs. flour, 3½ dessertspoonfuls baking powder, about 1 lb. of fat and butter mixed, a little sugar and salt to taste, and eggs if desired.

Mix the baking powder into the flour, then rub in fat and butter, and add the sugar and salt. Mix with milk into a smooth paste. Divide paste into round buns and lay them on the tin. Put them into the oven to bake for about twenty minutes. When done break into halves, lay them on tin, and dry out in moderate oven. These rusks are delicious with afternoon tea or coffee.

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DATE PUDDING.

Ingredients: 3 cups flour, 1 cup bread crumbs, ½ lb. dripping, 3 eggs, ¾ cup of sugar, 1 tablespoonful butter, 1 tablespoonful soda, and a pinch of salt.

Mix ingredients well together and add a little milk if necessary. Put in pudding cloth and boil for 3 hours. Serve with a sweet sauce.

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FIG PUDDING.

Ingredients: 4 ozs. bread crumbs, 2 ozs. flour, 2 ozs. sugar, 2 ozs. chopped suet, ½ lb. figs, a pinch of salt, one egg, and a little milk.

After chopping the figs and suet, mix all the ingredients together and moisten with the egg and milk. Then tie down in a buttered basin and steam for three hours.

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BAKED CUSTARD.

Ingredients: 1 pint milk, 2 eggs, and a little sugar.

Whisk the eggs well and add to milk: sweeten and flavour to taste. Put into piedish and bake gently in oven for half an hour. Set in pan of water to prevent scorching.

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JUNKET.

Ingredients: 1 pint sweet new milk, 1 teaspoonful concentrated essence of rennet, 1 teaspoonful white sugar.

Heat the milk until it is lukewarm, then add the essence of rennet and sugar. Pour into a bowl or mould, cover up, and put aside to cool when it is ready for use.

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BOILED ICING.

Ingredients: 1 cup sugar, ½ cup water, white of 1 egg, and 1 saltspoonful cream of tartar.

Boil the sugar and water without stirring until the syrup taken up on a fork will thread or rope. When it is nearing at that point, add cream of tartar, pour the boiling syrup over the egg—beaten to a stiff froth—and beat well. When it thickens and is perfectly smooth, pour it over the cake, dusted with a little flour, which prevents the icing from running off.

CANDY.—BOSTON CARAMELS.

Ingredients: 1 pint grated chocolate, 2 large cups brown sugar, 1 large cup syrup, ½ cup milk, butter the size of an egg.

Boil for 25 minutes, flavour with vanilla, and mark into squares.

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CANDY.—OPERA CREAMS.

Ingredients: 2 cups granulated sugar, ¼ teaspoonful cream of tartar, and milk.

Put enough milk on sugar to thoroughly dissolve it, and add cream of tartar. Bring slowly to the boil, stirring steadily all the time. When a little dropped into cold water is the consistency of putty, turn the mixture into a greased pan and set it aside until it begins to get cool. Beat it as long as you can do so, and then knead as you would dough, turning it out on a pastry board sprinkled with powdered sugar. Roll into a sheet half an inch thick and cut into squares. If flavouring is desired it should be stirred in just before the mixture is taken from the fire.

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TO PICKLE CAULIFLOWER.

Cauliflowers for pickling should be chosen when they are hard, yet of sufficient growth. Cut away the leaves and add a little of the stalks, break the flower into shapely pieces (do not use a knife). Throw the cauliflowers into a stewpan half full of boiling salt water (in the proportion of 2 ozs. of salt to a quart of water). Let them stand for three or four minutes, then take them out with a wooden spoon and spread upon a cloth to dry for at least 12 hours. When quite dry put them piece by piece into glass jars and pour the pickle over. The pickle should be made by adding to each quart of vinegar 1 oz. of mixed peppercorns, ½ oz. of ginger, a few small chillies, and 1 oz. of sugar. Let all nearly boil; when cold pour over the cauliflowers.

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TO PRESERVE MAIZE.

Use ordinary glass jars with new rubbers. To 9 cups of maize cut from cobs, add 1 cup of sugar, 1 cup of salt, and enough hot water to boil (about 1 pint). Boil 5 minutes. Put in scalded jars and seal at once. When cold store in cool place.

When you wish to use it, drain off all the liquid in the jar, rinse in cold water, drain, cover again with cold water, set where it will heat gradually and boil 5 minutes. Drain again and season with milk, butter, and pepper.

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DRIED MAIZE FOR WINTER USE.

Husk the maize, put into kettle of boiling water, and cook for 3 to 5 minutes, to set the milk in the kernels. Then cut from the cob, and, with the back of the knife, scrape the cob to get all the milk, and spread in shallow pans. Dry in slow oven or in the sun. When perfectly dry put into paper bags. Before using soak the maize overnight.

Maize dried in this way retains more of its sweetness, is much easier to prepare, and takes less space in the pantry than if canned and bottled.

PICKLED MAIZE.

(For Winter Use.)

Cut green maize from the cob and pack in a stone jar in the proportion of one pint (2 cups) of salt to two quarts (8 cups) of maize until the jar is full; then put a weight on top and cover closely. As wanted for use soak out the salt with fresh water, pour on boiling water the first time to seal up the milk in the maize, then using cold. When freshened cook like green maize.

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Readers are requested to send in their favourite recipes, and contributions of any kind—pertaining to the house—will be gladly received. Address to:—Jeanette C. van Duyn, Department of Agriculture, Pretoria.

We desire to thank the contributors of the following recipes:—

HOT TAMALES.

(Mexican Recipe.)

Scald a quart (four cups) of maize meal, using water to make it quite moist. Put a layer of the meal into some maize husks, forming a roll about six inches long in the centre of the husk.

To a pint (two cups) of cooked chicken, chopped fine, add a Spanish pepper chopped fine, and a teaspoonful of salt; put two tablespoonfuls of this mixture into the centre of the maize meal, roll the meal over the mixture, and the husks over the meal. Fold the ends of the husks and tie with narrow strips of husk. Put the bones taken from the chicken into the bottom of a kettle, add a sliced onion, three or four cloves, a bay leaf, salt and pepper, cover with cold water and let heat gradually to the boiling point. Lay the tamales upon the bones above the water, and cook about two hours. Serve hot in the husks.—MRS. J. BURTT-DAVY.

CREAM FILLING FOR SANDWICH CAKE.

Mix smoothly with part of a pint of milk three tablespoonfuls of sifted flour, and stir it boiling over the fire for eight or ten minutes; beat two eggs in the remainder of the milk, and add it to the mixture. Sweeten and flavour to taste. Stir well together over the fire, but do not let it boil.—MRS. H. GEERE.

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CREAM SANDWICH.

Ingredients: 3 eggs, 3 tablespoonfuls of sugar, 3 tablespoonfuls of flour, 1 tablespoonful of melted butter, 1 teaspoonful baking powder, 1 cupful of fresh cream.

Method: Beat butter and sugar together, add eggs (well beaten) one at a time; then add flour, and beat the mixture for ten to fifteen minutes: add baking powder. Bake in hot oven for about twenty minutes. Whip cream, and add a pinch of sugar and flavouring to taste. When sandwich is cool spread cream between the two sandwiches and on top. Sprinkle with desiccated cocoanut.—MISS S. MACKENZIE.

Green Tomato Soy.

Ingredients: 2 gallons green tomatoes, sliced without peeling, 12 good-sized onions also sliced, 2 quarts of vinegar, 1 quart sugar, 2 tablespoonfuls salt, 2 tablespoonfuls ground mustard, 2 tablespoonfuls ground black pepper, 1 tablespoonful ground allspice, 1 tablespoonful ground cloves.

Mix all together and cook until tender, stirring often lest it should burn. Put in small glass jars.—Mrs. R. A. Davis.

HOUSEHOLD SCIENCE NOTES.

In making loops for eyelets, of thread, make them over a match. This makes the loop just the right size and holds it firm while making the buttenhole stitch.

If you scorch a garment while ironing it, rub a lump of dry starch on the mark, then sponge it off. Repeat till the yellow disappears.

If you do not want your cake to stick to the pan after it is baked, grease the tin or pan; then sprinkle with a little flour or mealie meal, the latter answering the purpose even better. Shake the pan, then turn it bottom-side up and beat it so as to remove all flour that does not adhere.

To cause a paraffin lamp to give a better light put a piece of camphor in the oil vessel, or half a teaspoonful of vinegar will do almost as well.

If you grease the bottom of your boiler with butter before putting in the milk to boil, the milk will not burn.

When an oven is so hot as to scorch bread or cake, put in a pan of cold water to reduce the heat.

When the skin is hot and irritated from sunburn, never wash the face in cold water, but bathe very carefully in warm—not hot—water, then dry with a soft towel.

Put a tablespoonful of milk into the water in which old potatoes are boiled. This will prevent them becoming discoloured.

Ink stains can be removed from linen with the juice of a lemon.

Uses for Tea Leaves.

Tea leaves are frequently used for carpet sweeping, but they should not be used too wet nor left lying about long or else the colour is apt to come out of the carpet. Tea leaves, however, are valuable for various other purposes. Save the spent leaves for three or four days, soak them in a pail for about an hour, then strain off the tea water, which is an excellent wash for all varnished paint and makes it look equal to new. Window sashes and oilcloth should always be washed with it, and it is better than anything for window panes, looking-glass, and the glass of pictures. But it must not be used on unvarnished paint. The disagreeable odour of fish will also be removed from fish-knives and forks if left lying in it.

SIFT YOUR FLOUR.

When measurements—as a cupful—of flour are given in place of weight, it is necessary to sift it first. If a cupful of flour is taken out of a bag or barrel it will be compact and weigh heavy. Four teacups of sifted flour weigh about 1 lb.; unsifted almost 1¼ lbs. This is an important point when the ingredients of cakes are measured instead of weighed. Sifting aerates the flour and makes cakes lighter.

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TABLE OF WEIGHTS AND MEASURES.

1 quart sifted flour = 1 pound.
4 cupfuls of sifted flour = 1 pound.
1 pint granulated sugar = 1 pound.
2 teacupfuls of sugar = 1 pound.
1 large tablespoonful granulated sugar = 1 oz.
2½ cups powdered sugar = 1 pound.
1 pint closely packed butter = 1 pound.
10 eggs = 1 pound.
Butter, size of an egg = 2 ounces.
Butter, 1 common sized teacup even full = ½ pound.
6 large tablespoonfuls = 1 gill.
1 wineglass = ½ gill.
1 common-sized tumblerful = ½ pint.
Spices (ground), 2 large tablespoonfuls = 1 ounce.
7 common-sized nutmegs = 1 ounce.

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RISING MEASURES.

Use 2 heaping teaspoonfuls of baking powder to 1 quart of sifted flour.
Use 1 teaspoonful of soda and 2 of cream of tartar to 1 quart of flour.
Use 1 cupful of sour milk and 1 teaspoonful of soda to 1 quart of flour.
Use ½ teaspoonful of soda to each cupful of sour milk.
If the milk is *very* sour a little more soda may be added.

Useful Facts and Figures for Farmers.

HOLSTEIN-FRIESIAN CATTLE IN AMERICA.

For over a thousand years the home of the Holstein-Fresian cattle has been in Holland. A quarter of a century ago these cattle were brought to America under the names of Holstein and Dutch Friesian, being sold as different breeds and championed by different breeding associations. The name Holstein has no application in Holland, but refers to a small province in Germany between the Baltic and North Seas, about a hundred miles east of the Holland boundary, where black and white Dutch cattle are found. The word Friesian is derived from Friesland Province, Holland, and this is the name the breed should go by in America, as it does in Holland, for no such breed name as Holstein-Friesian is used in the latter country. In view of the fact that all the cattle imported to America from Holland are essentially the same, the breeders and importers finally came together and united their interests and agreed to call the breed Holstein-Friesian. If the word Holstein could be discarded, it would give a more appropriate and simpler name.

THE HOLSTEIN-FRIESIAN COW.

The Holstein-Friesian cow as a producer of milk, leads all other breeds and occupies a class by herself. Wonderful records have been reported during the past twenty-five years in America credited to Holstein-Friesian cows. Amongst the leading private tests the highest yield—30,318 lb. 8 oz.—was given by Pietertje II, 3273 H.H.B., during one year.

In 1901 a circular issued by the Holstein-Friesian Association stated that 77 cows had been received to advanced registry that had produced from 15,000 to 30,000 pounds of milk in periods of ten months to one year. A fair cow of the breed, when five years old or over, should produce from 7,000 to 9,000 pounds of milk a year with proper feed and care. Daily milk yields of Holstein-Friesian cows have been reported up to 122½ pounds in one day, this being the largest yield reported, credited in private test to Shadeland Boon II, 8892 H.H.B., owned by Powell Brothers, of Pennsylvania.

CHARACTERISTICS OF THE SHORTHORN.

In general conformation the Shorthorn adheres closely to the beef type, though certain tribes, notably Bates bred, tend strongly enough to milk production to be known as general purpose cattle. In size, mature cows usually weigh about 1,400 pounds, though they frequently exceed that, and in rare cases reach 2,000 pounds. The mature bull will easily attain 1,800 to 2,000 pounds; many weigh from 2,000 to 2,500, though the last figure is unusual. This may be regarded as our largest breed of cattle, although the Hereford is a close second, and is considered by many as its equal in weight and size.

TO MEASURE MAIZE IN THE BARN, POTATOES IN THE PIT, AND HAY IN THE STACK.

Two cubic feet of good, sound, dry maize will make a bushel of shelled grain. Therefore, to find how much grain is contained in a barnful of husked maize, find the cubic content of the barn, and divide by 2 for the number of bushels of shelled grain.

Suppose the barn to be 30 feet long, 12 feet wide, and 8 feet high, and packed with husked maize.

$$30 \times 12 \times 8 = 2{,}880 \text{ cubic feet.}$$

Divide by 2, and you get 1,440, the number of bushels of shelled grain in the barn.

In the case of potatoes in a pit, or of hay in a stack, make the same multiplication, and divide by 8 for bushels of potatoes, and by 512 for tons of hay (to the eaves of an oblong stack).—(*Queensland Agricultural Journal.*)

DRY MEASURE.

2 pints	=	1 quart.
8 quarts	=	1 peck.
4 pecks	=	1 bushel.
8 bushels (480 lbs.) ..	=	1 quarter.
36 bushels	=	1 chaldror

bu.		pk.		qt.		pt.
1	=	4	=	32	=	64
		1	=	8	=	16
				1	=	

LIQUID MEASURE.

4 gills	=	1 pint.
2 pints	=	1 quart.
1 quarts	=	1 gallon.
31½ gallons	=	1 barrel.
2 barrels or 63 gallons	=	1 hogshead

gal.		qt.		pt.		gi.
1	=	4	=	8	=	32
		1	=	2	=	8
				1	=	4

FITTING HORSES FOR MARKET.

There are probably few circumstances in the care and handling o horses in which food and labour will give greater returns than when devote to the fitting of horses for the market. Horses intended for the genera market should always be in good flesh or moderately fat, because fat, lik charity, covers a multitude of defects. A plump horse appeals to th average buyer. In fitting a horse for the market, he should be fed an abundance of easily digested, nutritious and laxative food. He should b thoroughly groomed every day, with plenty of brushing, as this give a

sleek and glossy coat that adds much to his general appearance and attractiveness. The mane and tail should be well brushed out, and if the skin at the roots of the hair is dirty, it should be well washed, and a little soft oil or vaseline applied. The horse should be exercised briskly for a short time twice daily, enough to keep him in good active condition; he should be taught to drive freely and handily, as soon as hitched up, as he will then show to the best advantage to an intending purchaser.

All horses intended for the general market should be well "broken." There is a rather widespread opinion among farmers that as soon as a colt is broken well enough to drive single and double, it is sufficient for market purposes, but this is not true. The extra time spent in properly breaking and training the horse will be well repaid in an increased price.—("The Care of Animals"—Mayo.)

APPROXIMATE VALUE OF HOUSEHOLD MEASURES.

45 drops of water is a teaspoonful.
1 teaspoonful equals 1 fluid dram.
1 dessertspoonful equals 2 teaspoonsful, or 2 drams.
1 tablespoonful equals 2 dessertspoonsful, or 4 teaspoonsful.
2 tablespoonsful equal 8 teaspoonsful, or 1 fluid ounce.
1 common-size wineglassful equals 2 ounces, or ½ gill.
1 common-size tumbler holds ½ pint.
A small teacup is estimated to hold 4 fluid ounces, or 1 gill.
1 pound of wheat is equal to about 1 pint.
1 pound and 2 ounces of maize meal is equal to 1 quart.
1 pound of soft butter is equal to about 1 pint.
1 pound of sugar is equal to about 1 pint.
A pint of pure water is about a pound.
-("The Horticulturist's Rule-Book"—L. H. Bailey.)

CRACKED HOOFS.

A "quarter-crack" is a crack in the wall of the hoof, beginning at the top or coronet, and extending downward in the wall. When the crack begins at the bottom and extends upward it is called a "sand-crack"; if in front it is sometimes called a "toe-crack."

The crack should be neatly cleaned out; if "proud flesh" exists, it is to be destroyed with a caustic, antiseptics applied to the crack, and then pine tar to keep out dirt and assist in healing. The crack should be drawn together by a shoeing nail driven across the crack, drawn tightly together, and clinched. It may be necessary to drill the holes for the nails, but in most cases a good shoeing smith can drive them. Small clips are made for this purpose, which can be fitted into grooves on each side of the crack, and closed by large pincers. A light blister applied to the coronet where the crack starts will stimulate the growth of horn. Cutting through the wall at right angles to the point of the crack will often prevent the crack extending further. The hoof should be kept well oiled. Care should be taken until it is well healed that the horse is not subjected to severe exertion that will split the crack open.—("The Care of Animals"—Mayo.)

TREATMENT OF DAIRY UTENSILS.

When cleaning dairy utensils always rinse them first with cold water. If hot water is used, the sticky albumen coagulates on the sides and bottoms of the tins and is very troublesome to remove. After rinsing with cool water, wash thoroughly with hot water, using plenty of alkali, such as washing powders or caustic soda, and "elbow grease." Then again rinse in fresh, hot water, and set them in the air to dry.—(*The Queensland Agricultural Journal.*)

TO CURE WESTPHALIA HAMS.

For two of common size, mix 1 lb. of brown sugar, 1 lb. of fine salt, and 1 oz. of pulverised saltpetre. As soon as the hams are cut, rub them with common salt; leave them for two or three days to drain, then wipe them dry; rub them well with the mixture, and put them into deep pickling pans, with the rind downwards. Keep them well covered with the salt and sugar; the third day pour over each a half-pint of vinegar. Leave them in the brine for a month, turning them every day; then dry, and scrape off the salt; rub them with bran, and smoke for four weeks.—(*Queensland Agricultural Journal.*)

CURES FOR BOTS.

The bot fly generally lays its eggs on the flanks of a horse or under the chin, almost always in spots, however, which the animal can reach with its tongue. Various suggestions have been made as to the best means to destroy the eggs. One grazier says that the simplest way is to strike matches and lightly burn the hair from the egg-infested patches without hurting the horse. To get rid of the worms inside, it has been shown by a German professor that a dose of tansy tea, followed a few hours later by half an ounce of salts, is a certain cure, hundreds of worms being passed by this means. Regular grooming would probably remove the eggs, but thousands of horses never get any grooming, and all that can be done with these is to try the match business or wash the parts with dilute carbolic acid or kerosene, or dose with tansy tea.

The United States Department of Agriculture lately described some tests upon a quantity if live bots taken from a horse which had been killed by them. Put into sage tea, they died in fifteen hours. This being too slow, they were tried with nitric acid, but that seemed to trouble them no more than water. Then they were put into an infusion of tansy; that killed them in one minute. A horse suspected of being troubled with bots was given some tansy tea in the morning and a dose of salts in the evening. The next morning the horse's excrement contained 1½ pint of the bots, and the cure, after repeated trials, is now said to be recognised as thoroughly effective.

WEIGHT OF CARCASS.

The dressed weight of a lamb in prime condition twenty-four hours after killing, if the live weight came to 90 lbs., is roughly 45 lbs.—(*Victoria Agricultural Journal.*)

SORE EYES.

Cows suffering from sore eyes should be treated as follows:—Bathe the eye with warm water, remove any grass seeds or other foreign bodies, and inject a few drops of the following lotion daily:—Sulphate of zinc 2 grains, boracic acid 10 grains, distilled water 1 ounce.

WHITE SCOUR.

The most fruitful source of white scour in pigs is dirty styes. The first step in curing is to provide clean dry bedding in a warm secluded spot. Give small doses of castor oil to remove offending material from bowels and soothe the irritation.

RUNAWAY HORSES.

It is impossible to stop a thoroughly frightened horse that is running away by pulling on an ordinary bit. There are bits made that enable the driver to close the nostrils, and thus to stop the horse's breathing, so that he will soon "choke down." There are other kinds of bits that are very effective. By acting quickly and vigorously, a driver can often prevent a horse from getting beyond control. If it is possible to rein the horse into a wall before he has acquired much headway, it is usually a good plan. When a horse is beyond control, and is running rapidly, it is generally the safest plan to guide him, so far as possible, and to allow him to become exhausted, when he can be stopped. There is usually less danger in staying with a horse that is running rapidly than in attempting to jump. Every case must be decided as the varying circumstances will indicate. Runaway horses are always dangerous, and should be treated accordingly, and no person not fully qualified should ever be allowed to handle them. —("The Care of Animals"—Mayo.)

Extracts from Exchanges.

THE GENERAL PURPOSE COW.

("The Breeding Industry"—Walter Heape.)

The far-seeing dairyman wants cows which will yield the greatest amount of milk of the best quality in winter as well as in summer, and he wants sure breeding returns. Until recently the aim of all cattle breeding in England was the production of beef. The dairy cow is a modern development with us in comparison with those who originally built up the Guernsey and Jersey breeds of cattle. With comparatively few exceptions the most elementary needs in breeding for the dairy are still not understood. It is beef which is in the breeder's eye, and he cannot eradicate it. The result has been a "general purpose cow," a cow which is capable of being fattened for the butcher when it ceases to be used for milk. It is not physiologically reasonable to suppose you can get, economically, the best milk and a maximum quantity of it from an animal which is essentially fitted to fatten; nor can you expect to be able to produce the best meat on a cow or on the offspring of a cow specially designed for milking. The "general purpose cow" is really fitted for neither one thing nor the other, and where the *best* meat and the *best* milk is required, as it surely will be if it is not required now, this mongrel is doomed. It seems odd that she should continue to exist; she is kept for milking in a dairy for a number of years, she is expensive to feed as a milker, and she gives comparatively poor milk returns; but apparently because she is worth a few pounds more to the butcher when she is done with for the dairy, she is preferred to a first-rate dairy cow, from which much better annual returns can be got; and, moreover, she leaves offspring which are not good.

MAINTENANCE OF A LAWN.

All the operations connected with the maintenance of a green sward are directed towards securing a uniform sod or turf over the entire extent of the lawn. In order to secure this the plants which constitute the lawn should be kept in a luxuriant, vegetative condition and never allowed to go to seed. There is no operation connected with plant life which is so trying upon the vitality as the production of seed. In order to keep a close, even surface over the area, it is necessary to use a mower frequently, but in using the mower the clipping should not be done close enough to deprive the plants of sufficient leaf area to carry on their normal functions; that is to say, as a general rule the lawn mower should be set high rather than low. Upon newly established lawns the operation of clipping should not be delayed until the grass is too high. As soon as a mower with a blade two inches high will cut the ends of the leaves, the mower should be passed over the surface. By repeating this at close intervals during the growing season a better and more uniform stand of grass will be secured.

It is a mistake to allow a lawn to go in an unkempt condition during the first months of its existence. It should from the beginning be subjected to the same treatment which is to be carried on later in its life. It is not

advisable to clip the lawn frequently during period of drought, but even during these periods it is not well to allow the plants to produce seed stalks. The general plan of keeping a lawn clipped to a height of two inches is a very safe one to follow. The clipping, too, should be sufficiently frequent to prevent the necessity of raking off any considerable quantity of material after each clipping. If the soil is moist, very rich, and the growth luxuriant, it will be necessary to rake off the clippings, but on comparatively poor soils the clippings will not be detrimental unless they produce an unsightly effect. Before growth has advanced to any considerable extent each spring, the lawn, as soon as it is comparatively dry, should be gone over with a heavy lawn roller, so as to embed firmly any of the grass roots which may have been loosened by frosts and to reduce the surface to a uniform condition.—(U.S. Department of Agriculture—Farmers' Bulletin, "The Lawn," by L. C. Corbett.)

WOMEN'S INSTITUTES.

By Miss Blanche Maddock, of Canada.

I feel that this is woman's age. We are now on our trial, and the weal or woe of this new century lies largely in our hands. Does it not become us to pause and consider the responsibility laid upon us? There is now scarcely a convention or gathering of any kind for the bettering and upbuilding of society where women are not represented. This has not been accomplished by any "declaration of rights" on the part of women, but by the courtesy of the men who have had these matters in charge. In some quarters we hear a great deal about the necessity of woman asserting her rights; this is not our aim.

What are women's needs? Women have long felt the need of something to lighten the burden of housework, but in many cases we have adopted wrong means to remedy the evils felt. It has been truly said that where her life touches another there she has influence and there is her place. Who is more interested in the present-day reforms than women? And the question is: What is the best method of dealing with them from a woman's standpoint? In answering that question I would say: "From the standpoint of the home." I do not say this in a depreciating sense, By no means. I think if our homes were all they should be, we would look into the future feeling assured that all needed reforms would reach a speedy settlement. Gladstone has truly said, "Home is the foundation of the State"; then, surely in doing away with the home and privacy of family life we are undermining this foundation, and it will surely lead to the decay and crumbling of the nation.

* * * *

What, then, is the remedy? We know that in many places girls are becoming dissatisfied with home life. They are ready to go into almost anything—store, office, factory—anything, rather than stay at home. For years the same trouble existed among the boys on the farm. Many plans have been advanced for a solution of the problem, but it has been found that the only successful method of keeping the boys on the farm is to give them a scientific agricultural education. In order to meet this need agricultural colleges were introduced, the benefits of which it is not necessary to mention. But after all, they have only reached a limited number of

the young men of the country. Then, in order to meet the further need, the farmers' institutes were organised. Since the formation of the farmers' institutes farming has received a new impetus. Farmers recognise their work as a profession, and the old cry of drudgery is not so often heard. But this cry comes loud and clear from the farm home, and we shall continue to hear it until the same remedy is applied—*the need of scientific knowledge for women!* This has been recognised, and domestic science schools have been instituted; but, as in the case of the agricultural colleges for boys, we find that these schools only reach a very limited number of our girls. They do not reach the housekeepers of the present day, and in order to meet this need in Ontario, women's institutes have been organised. At the commencement of 1900 there was only one institute in Ontario, but under the management of Superintendent Creelman, who has spared no pains in advancing the work, we have now 32 institutes. In addition to these there are a number of branches with a total membership of 1,503.

The Government grants 10 dollars (£2) a year to each women's institute that has a membership of 50. The women generally meet once a month, either in a private house or hall, and carry on their own meetings. Most of them are conducted by local talent, but in some cases, where they have a good membership and sufficient funds at their disposal, they send to an outside place for a speaker on some subject in which they are particularly interested. We have many organisations for women at the present time, but to my mind the women's institute covers the ground very completely and is just what the country women need.

Correspondence.

This column will be devoted to correspondence, and an endeavour made to reply to all inquiries upon agricultural topics, or concerning any of the articles published from time to time in the "Journal."

Correspondents will kindly write on one side of the paper only. No manuscript will be returned.

All letters must be addressed to the Editor of the "Agricultural Journal," Department of Agriculture, Pretoria.

TRANSVAAL NAVEL ORANGES AND GRAPE FRUIT.

The following interesting letter, addressed to the Secretary, Office of the Transvaal Agent-General, London, was received by the Horticulturist of this Department:—

I have the pleasure to inform you that the supply of navel oranges handed over to me to sell on behalf of your account are now all disposed of with the exception of two cases, and long before this letter will have reached you the parcel will have been sold. The boxes contained from 140 to 160 odd oranges, and the gross sales averaged from 12s. 6d. to 14s. per box. I think you will agree that this is a good price.

With regard to the grape fruit, I regret to inform you that the appearance of this fruit is acting very materially against its sale. Grape fruit from the West Indies is, to-day, selling readily at 15s. a case of the same size as that which your fruit is packed in, whereas it is very difficult to get an offer for your fruit. I prefer not to express an opinion to-day as to what the fruit will eventually fetch, but I am afraid it will be very little—perhaps under a quarter of that made by the West Indian fruit.

I venture to recommend that it will not be prudent to ship over more grape fruit, as it is not sufficiently large, or of a sufficiently good colour (as compared with the West Indian fruit) to sell well on this market. Further, unlike oranges, which have always a sale, I doubt if even the West Indian fruit would sell so well were it not for the great number of visitors over for the Exhibition for whom the hotels buy the fruit as a novelty.

* * * *

Navel oranges, such as sent over this time, if they maintain the same excellent condition on arrival, will always command a good sale. If they come over in very large quantities, and land at a time when the weather is very bad and checking the holiday makers at the different seaside and other resorts, the prices of the oranges will naturally fall, but, in my opinion, they will always sell at a fair price no matter how large the quantity or how bad the weather, as they are recognised as a cheap healthy food. The working classes only really know apples, oranges, and bananas out of all the fruits grown or landed in England, and even of those three they prefer the orange as it carries the best in their pockets and peels easily.

With regard to the packing of the oranges there is no fault to find whatever. They have travelled well in the ventilated hold, and

so come at the rate of 25s. a ton, instead of the cold storage rate of 50s. per ton. They have not been squashed in their large box, which is exactly a similar box to that in which the Californians have been sending over oranges in for very many years. I am a strong advocate of the large box (which I introduced to the Natal Government) in distinction to the small trays containing 40 or 50 oranges, and more than half filled with wood wool. When oranges come over in quantity the Covent Garden buyer will count the fruit and buy that which gives him most of what he wants for his money, which is, naturally, fruit, and not wood. It is my belief that when the trade learn that Transvaal oranges have not been in cold store, they will command more popularity with the trade than those which have been chilled, as these latter always deteriorate after a short time in the heat on coming out again.

The only thing against shipping in the ventilated hold is the necessity of picking the oranges exactly right. If this is not done, great failure may result. The oranges which I have had the pleasure of selling were packed, I see by their paper, by A. H. Malan, of Hartebeest Hoek. They arrived in perfect condition as far as packing is concerned, with the exception of about ½ per cent. to 1 per cent. which were a little pitted by branches while they were growing, or the weather. Mr. Malan is to be congratulated, and if other farmers would hit off the right time to pick the fruit in the same way as he has, no fruit will fail to travel in the hold, and Transvaal oranges will always be popular on the London market. With cheap packing like the present, and cheap freight in the hold, it will always be remunerative. I am curious to see how the ordinary Transvaal orange will travel and sell. Its sweetness should make it go, when the public know it, though it may not fetch quite so much.

Yours, etc.,
MARTIN HALL.

BEETLES ON LUCERNE.

To the Director of Agriculture.

Sir,—Under separate cover I send you sample of a slate coloured beetle which is doing a lot of harm to my lucerne. Though I am out of your sphere I hope you won't mind helping me which I feel sure you can do.

Yours, etc.,
G. MERSON.

Lourenco Marques, Delagoa Bay.

Answer.—The beetle which you enclosed is known, technically, as *Cantharis veleta*, and, in the Transvaal, usually attacks lucerne by eating only the flower. I might mention that this beetle is very closely related to the South American insect from which the compound known as spanish fly is made. It is very difficult to combat in the Transvaal, but we do not consider it of such great importance as to employ the necessary amount of labour to destroy it.

A spray of any of the arsenicals such as paris green would, of course, be destructive, but it is difficult to spray a field of

lucerne unless the plants are very young. In cutting and making hay of the lucerne a great many should be destroyed in the process. If you wish to go to the trouble, I should suggest that you try cutting the crop, then spraying the crop with paris green in the proportion of 1 lb. of paris green to 150 gallons of water to which has been previously added some 2 lbs. of freshly slaked stone lime. This arsenical is not soluble in water, and will wash off from the plants with the first rains, so that there is no danger in using it.

Yours, etc.,
C. W. HOWARD,
Entomologist.

GRAIN MOTH IN MEALIES.

To the Director of Agriculture.

Sir,—I wish to state that I am forwarding by this mail a small sample of mealies which I noticed have two kinds of insects amongst them. I have never seen anything like them before amongst mealies. Could you give me any information regarding same? If so, I shall be greatly obliged.

Yours, etc.,
C. SAUNDERS.

Heidelberg.

Answer.—I have carefully examined the sample of mealies which you forwarded to the Director of Agriculture, and I find only one insect present. This insect is a small moth known as Angoumoise grain moth. This is a very common pest of mealies in the Transvaal, and is usually found along with weevils. Unlike the weevils, however, it is generally considered that they may begin to infest the mealies while still in the field. Great care should, therefore, be taken in the gathering of the mealies to see that the cobs are kept covered and not exposed any more than is absolutely necessary. If you have an air-tight room in which you can store your mealies you can easily destroy these moths by fumigating with carbon bisulphide if the mealies are in sacks. The mealies should not be stacked more than three or four sacks high. The carbon bisulphide should be poured into shallow dishes and set on top of the sacks at short intervals and allowed to evaporate. The fumes are heavier than the air and will sink through the mealies to the bottom. You should use from 1 lb. to 1½ lbs. of the carbon bisulphide to the ton of grain. Great care should be used as the fumes are explosive and on no account should any fire or matches be used during the operation. You should also exercise great care to see that the buildings in which the mealies are stored are thoroughly swept out and cleaned before placing the grain in them.

There was also present in the specimens you sent a small four-winged fly which does not destroy the mealies, however, but is a parasite on the maggots of the moth in the mealie kernels. It is, therefore, beneficial and not destructive.

C. W. HOWARD,
Entomologist.

MEALIE COBS AS FOOD.

To the Editor of the *Agricultural Journal.*

Sir,—From information received I have reasons to believe that the mealie ear after removal of the mealies, when ground up contains a certain amount of nourishment to cattle.

In fact, it has been said to me that, in Argentine and Canada, the mealie cob is milled and made use of as a cattle food where it has given great satisfaction.

The constant complaint of the dairyman is that the foodstuffs for dairy cattle are too expensive. This expense, together with the high wages paid and the competition which now exists in this Colony, makes the dairy business not as remunerative as could be desired. If one compares the prices obtained for milk at Capetown and the cheap cow food there, with the conditions existing here, there is not the slightest doubt that the town dairyman has not an easy time of it. In order to make his business a financial success he requires to be constantly on the *qui vive* for cheaper foodstuffs so as to reduce the cost of feeding.

The mealie cob, after the removal of the mealie, is now entirely used by the farmers as a fuel, and, therefore, has little or no commercial value. If it could be made use of by the dairy farmer in some way or other as an additional foodstuff, the rejected mealie cob could become a blessing

You would confer a great obligation on me and my friends if you would give us, through your *Journal*, some information on this subject. At the last agricultural show your Chemistry Division gave an exhibition of what various foodstuffs were composed of, and if you could give us a similar illustration of the mealie cob we would be able to know in how far it might become a nutritive food to cattle. A list of foodstuffs with what they contain and how they should be given to cattle would be of great value to the dairy farmer for obtaining a well-balanced food.

Yours, etc.,

MARTEN MULDER,

Dairy Farmer.

Johannesburg.

Answer.—Mealie cobs, if finely ground and mixed with foods rich in protein, such as cotton-cake, ground-nut cake, or even bran, could be utilised for feeding cattle. Their feeding value, however, is not high, being rather less than that of oat-straw or mealie stalks. They contain a good deal of indigestible fibre, but their chief defect for dairy cows is their poverty in protein, which is the flesh-forming constituent of foodstuffs, and is also important in milk-production.

In America the maize and cobs are often ground together and sold as "corn and cob meal," and this is quite a good method of utilising the cobs as they only slightly reduce the feeding value of the mealie meal. To give a well-balanced ration this would have to be fed with lucerne or other leguminous hay.

There is a possibility that, in the near future, a considerable quantity of pea-nut or ground-nut cake or meal may be put on the Transvaal market. This should prove a boon to dairy farmers, as the pea-nut, or "monkey-nut," is so rich in protein. If cows could be induced to eat a mixture of this meal with three or four times its weight of ground mealie cobs, the problem of a cheap and well-balanced food for dairy cows in this country would be well-nigh solved.

Yours, etc.,
ROBERT D. WATT,
Acting Chief Chemist.

NITRO-BACTERINE.

To the Chief Chemist.

Sir,—Kindly let me know what your Department thinks of the nitro-bacterine so much written about in the *Review of Reviews*. I believe there are many farmers who are keenly interested and would be glad to learn more about it.

Yours, etc.,
P. GEO. GREWAR.

Boksburg.

Answer.—As you are probably aware there are four substances necessary for plant growth which may be present in insufficient quantity in a soil, namely, nitrogen, phosphoric acid, potash, and lime. You also doubtless know that four-fifths of the atmosphere consists of nitrogen gas, so that, with ordinary plants growing in a great many of our soils, it is a case of "nitrogen, nitrogen, everywhere, and not a drop to eat." Some twenty years ago it was discovered that by means of certain bacteria ("germs" or "microbes") living in wart-like nodules on their roots, certain plants were successful in obtaining their supply of nitrogen from the air. These plants all belong to the group known as leguminosae, and include all kinds of beans, and peas, clover, lucerne, etc.

Now, nitro-bacterine, when properly made up, consists of myriads of these microbes growing and multiplying in a proper culture solution. When the seeds of a leguminous plant are inoculated with such a solution just before sowing, the microbes live in the soil till the plant has germinated. They then penetrate the root and form the curious nodules in which they live and multiply, at the same time absorbing nitrogen from the air and passing it on to the plant.

In a great many of our Transvaal soils the microbes for certain plants are already present, and the only effect of inoculating with nitro-bacterine is to increase their number. If the microbes are not present in the soil, then inoculation must do good as it will give the plants the power to get the much-needed nitrogen from the air. As I fear that the importance of nitro-bacterine has been much exaggerated in a certain section of the press, I would just remind you of its limitations:—

(1) It can only be the means of supplying one element to plants, namely, nitrogen; and though many of our

Transvaal soils are deficient in this substance, a far greater number are deficient in phosphoric acid. A great many are also deficient in lime, and a few in potash.

(2) It can only have a beneficial effect on leguminous plants—beans, peas, lucerne, clover, pea-nuts, etc.

(3) Many of our soils probably contain a sufficient number of the microbes already without using nitro-bacterine.

This Division inoculated a large number of samples of lucerne seed with a culture of our own last season and we await the results with interest.

Yours, etc.,
ROBERT D. WATT,
Acting Chief Chemist.

BOLL WORM ON COTTON.

To the Government Entomologist.

Sir,—I am sending you some bolls of cotton attacked, I am afraid, by the boll worm; also some leaves. The latter disease, whatever it may be, is spreading over the whole plantation, the leaves are curling and getting a ruddy colour. The plants are rattooned* from last year's crop, the soil gray alluvial loam, 35 feet above and 400 yards from the bed of Komatie River. The season has been a very dry one. The first picking (lower bolls) was very good; the crop is again in flower bearing heavily, but a large percentage of bolls of all sizes are falling to the ground.

Yours, etc.,
A. R. TORRENS.

Piggs Peak, Swaziland.

Answer.—You are quite correct in surmising that this insect is the cotton boll worm. The insect is very common throughout the whole of South Africa, being a pest on tomatoes, tobacco, and mealies, and, undoubtedly, if cotton culture increases to any appreciable extent in the Transvaal, it will become a serious pest of cotton, as it is in the United States of America. I shall be very glad of any observations you are likely to make upon the habits of this caterpillar, the amount of damage you think it does, time when you first notice it appearing, and so forth.

In America it has been found that the only methods which can successfully be employed to combat this pest are what are known as cultural methods, such, for instance, as the deep ploughing of the land early in the winter, growing the early maturing varieties of cotton, use of fertilisers to ensure an increase of fruit production, planting as early as possible in the spring, and thorough cultivation.

It has been found that the boll worm attacks the cotton after the mealies have become too ripe and hard for the worm to eat them, that is providing the mealie fields are near to the cotton fields. It has also been found that the boll worms are not so apt to attack the mature bolls, hence the reason for planting early varieties, and for

* To sprout from the root.

hastening their early maturity. As the pupa passes the winter in the soil, early winter ploughing is essential. The favourite food of the boll worm is the mealie, not only in America but in South Africa also, hence trap crops of mealies close to cotton fields will often prevent any attack upon the cotton.

Yours, etc.,
C. W. Howard,
Entomologist.

WORMS IN CALF.

A correspondent—Mr. Chas. J. Oxford, of Wolmaransstad—writes as follows:—I have a calf suffering very badly with worms. The calf is four months old, has been suffering about a month—since I bought it—and is in a very weak condition. Could you kindly let me know some remedy? I have tried turpentine and raw linseed oil, but with no effect.

Answer.—For worms in calf try the effect of one teaspoonful of liquid extract of male fern shaken up in a little warm milk. If turpentine has not given good results I have no doubt this will, but turpentine is usually effective if given in sufficient quantity—a tablespoonful shaken up in about four ounces of raw linseed oil or castor oil is generally satisfactory. If this does not answer please write again.

C. E. Gray,
Principal Veterinary Surgeon.

EYE DISEASE AMONGST SHEEP.

To the Editor of the *Agricultural Journal.*

Sir,—The sheep in this portion of the district are suffering from an eye disease hitherto unknown here, though I have seen young calves affected in a similar manner and in different parts of the country during the rainy season. In this case, application of a patent medicine called "Haarlem oil" to the eye-ball by means of a feather proved successful in almost every instance. In the other it does not seem to have the slightest effect.

First the membranes of the eye (sheep's) appear red and inflamed, and, though being systematically treated as above mentioned and purged, these symptoms grow more acute until the eye-ball bursts from its socket—somewhat like the seed of a ripe gooseberry would under the pressure of forefinger and thumb—and finally becomes dry. It is needless to say that the animal is useless in such a condition.

Will you kindly let me know what the affection is called, and what is the correct method of treating it?

Yours, etc.,
J. E. Fargher.

Cyferbult.

Answer.—From your description of the disease from which your animals are suffering, I am inclined to think they are suffering from a form of contagious ophthalmia; I suggest that you separate the

affected sheep from those that are healthy and wash out the eyes daily by opening the eyelids and injecting one of the following solutions on the surface of the eye with a glass syringe:—

Boracic acid	1 drachm
Water	1 pint
or	
Corrosive sublimate	2 grains
Water	14 ounces

If this is not satisfactory kindly communicate with us.

Yours, etc.,
C. E. Gray,
Principal Veterinary Surgeon.

VALUE OF SILAGE.

The following interesting letter was received from Mr. J. Rabie, Steynplaats, Belfast:—

"In March last I decided to try and make some ensilage. I dug a hole 25 ft. x 10 ft. x 6½ ft. and filled this with mealie stalks, African pearl millet, sweet grass, tambookie grass, and whatever I could lay my hands on which was green and that I knew cattle would eat. I cut it up with a chaff-cutter and tramped it down well with horses. I opened the hole yesterday and found the contents in splendid condition; my cattle eat it splendidly. I intend making three times the quantity next season."

WINTER GRASSES: *PHALARIS COMMUTATA.*

Mr. Ivon Fry, Middelburg, writes as follows:—

"Can you kindly inform me if the above fodder plant has been tried in this country, and if it has been a success or not? Can you also inform me where I can procure some seed? As I believe it is a valuable winter fodder plant, I would like to try it. I have water for irrigation all through the year and my soil is good."—Ivon Fry, Ivonhoe, Middelburg, Transvaal, 9th August, 1908.

Answer.—We gave this crop a trial at Skinner's Court last season, but obtained no germination probably because of drought at and after the time of sowing; possibly the seed was not good. I am arranging to make a fresh test this year, and shall try some under irrigation. It would be advisable for you to wait till we have carried out our tests when we shall be glad to report if you will remind us. If, however, you are anxious not to delay I believe you can obtain seed from local seedsmen.

If you are proposing to sow a winter grass under irrigation, I would strongly recommend you to try rescue-grass (*Bromus Willdenowii*), and also a little cocksfoot and perennial rye-grass. We have proved that these give excellent results under irrigation in winter. If you care to we shall be glad to furnish you with a little seed for trial under the usual co-operative regulations, a memorandum of which is enclosed herewith.

Jos. Burtt-Davy,
Government Botanist.

Editorial Notes.

In those histories which tell the story of the middle ages we read of that wonderful revival of learning which had its origin in the fair city of Florence, took firm root on the banks of the Arno, and, spreading throughout the whole of Europe, permeated all literature and art, science and religion, history and philosophy. Nor do we think we greatly err if, to-day, we speak, in like manner, of the renaissance of agriculture in the Transvaal.

When we recall some of the more important bills recently passed in Parliament affecting the rural industry—such as the Fencing Bill, the Co-operative Agricultural Societies Bill, and the Irrigation Bill—it must be apparent to all that we see the dawn of a new and a great agricultural era. And if further evidence were needed in support of this contention it would be found in the first Annual Co-operative Congress, which was held in Pretoria on Thursday, 3rd September. This Conference, which was presided over by the Hon. Ewald Esselen, K.C., was composed of delegates from every district in the Transvaal and various officials from the Department of Agriculture, and was a gratifying tribute to the successful work of the Superintendent of Co-operation—Mr. B. Stilling-Andersen. The proceedings were opened by the Right Hon. the Minister of Agriculture, who delivered a speech which will long be remembered by those who were privileged to hear it.

Speaking of the principle of unlimited liability which has been adopted by the Government of the Transvaal, General Botha said: "One of the greatest advantages of the unlimited liability system is that you require no large capital to start with, as the expenditure can be met out of the actual receipts, the small amount necessary to start with having been obtained from the Land Bank. One of the best guarantees the system offers is that the officials of a society are responsible, and may be prosecuted if the work is carried on improperly, or if, for instance, they take a commission from buyers. A second safeguard is afforded by the fact that the regulations of societies must be registered with and endorsed by the Government, and yet another by the societies having to publish their accounts at least once a year. I think this should be done even oftener, for we want to inspire confidence, and that we can only do by the greatest openness and the most sterling honesty. Besides all this, the Government has the right at any time to appoint an independent auditor to report upon a society's affairs. These privileges conferred upon co-operative societies by the new law could never have been given to such enterprises under a system of limited liability, for there would not be enough money to start them all with the capital they would require. A limited liability company does not fall in the same category as those co-operative societies, and must be registered under the ordinary companies law, and such a company even if established to trade in mealies or other agricultural produce, is on the same basis as a gold or coal mining company, and if one were entitled to assistance the other would be also.

"It is essential that we keep the two things entirely distinct, for co-operative societies and limited liability companies are two things which must be kept entirely separate. The registration of the latter is more expensive, the capital must be guaranteed, and they must pay licenses to trade. It is true that so far we have only had acquaintance with the principle of limited liability, and we have paid dearly enough for our experience of that. We are to try the other system now, and we ask every one to assist in making it a success. If any of us do not believe in this principle, let us not hinder those who wish to give it a fair trial. For the time has come when we must do something, and in doing that we must use our very best efforts. There has been a great deal of criticism of this principle, in my own as well as other constituencies; but I am satisfied that the principle stands on a firm basis, and that it will take a great deal more than criticism to upset it. Criticism is the way to perfection.

"It has given me the keenest pleasure to find how the members of both white races in the country are prepared to work together, and I tell you that when we have genuine co-operation all round the time will have come when we can make the Transvaal what it is capable of becoming. There are some among the older population who may ask what a newcomer, like Mr. Andersen, for instance, can teach us; but we must remember that the world does not stand still, and that we must profit by the experience and accomplishments of other countries. I wish again to impress upon you the necessity of working hard together. I have no hesitation in prophesying that the day will come when the people of the country will be thankful for the day that the first Co-operation Congress was held. I give you my best wishes for the success of the Congress, and I can also give you the assurance that where the Government's assistance is necessary you can reckon on both parties in Parliament doing right by everyone whatsoever." (Applause.)

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A few months ago the first citrus packing shed was started in this Colony, and a few notes on this auspicuous event may be of interest. If you take the morning train from Pretoria you will arrive without undue haste in the picturesque town of Rustenburg, some four and a half hours later, having travelled a distance of 69 miles. Rustenburg is prettily situated, well wooded and well watered, and with the Magaliesberg Mountains sweeping round to the south it reminds us most vividly of the lovely town of Riverside—the centre of the most famous orange region in California. And if Potchefstroom can boast having been the Ancient Capital, Rustenburg may with equal pride remember that within her historic precincts assembled the first Volksraad of the Transvaal. Here, too, you still may see the cool thatched cottages of the voortrekkers of "'52."

At the time of our visit the first oranges were being packed for the English market. In a little shed the members of the Rustenburg Fruit Growers' Association were busily engaged, under the direction of Mr. R. A. Davis, the Government Horticulturist, in sorting, grading, and packing oranges. The grading machine imported from Florida sorts oranges in sizes of 96, 112, 132, 150, and

Plate 19.

A Tobacco Factory in Rustenburg.

175 to each box. It is estimated that one million and a half oranges will be shipped from Rustenburg this season. At first sight this seems a large figure, but we know it is only a very small beginning.

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To get some idea of the vast potentialities of this industry let us take a few simple statistics. The District of Rustenburg consists of roughly 9,000 square miles, or in other words 5,760,000 acres. More than half of this enormous area is, however, bush veld, more or less waterless, and as yet untouched by the plough. (See Plate 23.) But let us take that curbing ribbon of land which runs from Pretoria to a point 30 miles beyond Rustenburg, lying at the base of the northern slope of the Magaliesberg Mountains—100 miles long by some 4 miles broad—and we get an area of 400 square miles or 256,000 acres of rich loam, bearing a striking resemblance to the celebrated orange soils of Southern California. Plant this area—only a very small portion of the possible citrus lands of the Transvaal—and you will set out 19,200,000 trees of an annual market value of £9,600,000.

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AFTER the experimental shipment of last year, which was entirely successful as regards prices, Mr. Jan du Plessis, one of the largest orange growers in the district, in consultation with the Government Horticulturist, came to the conclusion that a central packing establishment was necessary for the success of the industry. Accordingly, the hon. member for Rustenburg, Mr. Louis Jacobsz, M.L.A., together with Mr. Stilling-Andersen, the superintendent of co-operation, and Mr. R. A. Davis, called a public meeting which was largely attended, and at which a unanimous vote in favour of the principle of co-operation was passed. A Provisional Committee was formed at a later date, and another meeting was held, at which a permanent board of directors was formed as follows: J. A. du Plessis (chairman), H. K. J. van Noorden, C. H. Mullett, R. W. Posthumus Meyes, J. I. Eloff, R. J. P. van Tonder, A. P. Conradie, D. Heystek (secretary), P.O. Box 41, Rustenburg.

Mr. J. A. du Plessis was elected chairman, and final arrangements were made for the export of citrus fruits. The great interest taken in this movement is plain from the fact that sixty members have already joined the Association.

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UNFORTUNATELY, fruit growers are still hampered by excessive railway rates, and much difficulty is found in securing a reasonable rate for local shipments. Indeed the rate is so high at present as to seriously handicap our farmers in obtaining a foothold for their produce in the south-eastern portion of their own Colony. The towns in these districts, being close to the Natal border, offer a ready market to the farmers of our sister Colony to the exclusion of those in the Transvaal.

Furthermore, it has been found necessary to import boxes from Natal for the use of the local trade. As an instance of excessive freight it may be stated that a consignment of box material for the use of the Rustenburg Co-operative Fruit Growers' Association,

which cost £51, was charged freight to the tune of £37 16s. 10d. This is surely a case which we may well bring before the notice of the Railway Committee. At the same time we must not omit to mention that the authorities of the C.S.A.R. have acted most generously in regard to our export trade, and we are certain that they will afford equal facilities for internal commerce and the development of a new industry.

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It was satisfactory to note that the fruit being exported to England was choice and clean, and we must congratulate our growers on this state of affairs. Moreover, we trust that the Rustenburg Association will resolutely refuse to receive any oranges or naartjes which have been grown in an orchard infested with insect or fungoid disease. The orange in the Transvaal suffers mainly from two diseases—scale and root-rot. Both are amenable to treatment—the first by fumigation and the second by cultural methods—and it is to be hoped that all citrus growers will entirely eradicate these troubles from their groves. There is an old Boer proverb which runs: "Die limoen boom moet mense zien," which, being interpreted, means that the orange needs attention, and there is no tree which responds more generously to a little kindly treatment. A tree bearing this glorious golden fruit laden with scale and rotten with the canker of long years of root-rot must ever remain the silent witness to past neglect and present indolence, and a standing menace to all adjacent orchards.

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Recently, a marked advance has been made in the tobacco industry in Rustenburg, and two factories are now actively engaged in treating the Magaliesberg leaf. The United Tobacco Company started about a year ago, and buys leaf from the farmers for cash prices, paying from 6d. to 10d. per lb. for ordinary Boer tobacco. The tobacco is put up in the orthodox fashion in 2 oz., ¼ lb., ½ lb., and 1 lb. bags, sold under the name of "Springbok Brand," and finds a ready market all over South Africa.

Another tobacco factory in Rustenburg is the New African Industrials, Limited, which makes the "Veldt" brand of pipe tobacco and cigarettes. For some time past seed has been specially imported by this company, and distributed to the farmers, resulting in a marked improvement in quality. When the leaf is brought in it is sorted, graded, and baled, after which it is stowed away in what is called the leaf magazine, and allowed to mature for at least twelve months. Up to this stage both the pipe and cigarette tobaccos are treated similarly. Then the leaf which has already been sorted for pipe tobacco undergoes the process of fermentation. After the fermentation is completed the tobacco is cut, and for this purpose the company has imported two cutting machines from England, which together are capable of cutting 14,000 lbs. of tobacco daily, whilst the packing is done by a most ingeniously constructed machine.

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Mr. F. B. Smith, the Director of Agriculture, left Pretoria on the 17th August on a six months' tour. During his absence Mr. Smith will, on behalf of the Department, proceed to England, Holland, the

United States of America, and Canada. Amongst other things Mr. Smith proposes: To make arrangements for, and to settle, the lads elected to the Government Scholarships at the Royal Veterinary College, London, and the New York State Agricultural College at Cornell, the Iowa Agricultural College, and the Ontario Agricultural College; to purchase a thoroughbred stallion and some thoroughbred mares, and also some Freisland cattle in order to ascertain whether animals of this particular breed reared in America will suit the Transvaal; to inquire into the methods of grading and handling maize in America, and to ascertain the best methods of disposing our wool, maize, and citrus fruits in Europe; to obtain particulars ot the design and management of storehouses for grain, etc., and of stock markets, abattoirs, and cold stores; to study the methods of collecting agricultural statistics in vogue in Great Britain and America, and the manner in which they are compiled in those countries and also in the International Agricultural Institute in Rome; to obtain particulars of the manner in which the tobacco industry is assisted by Government in the United States of America and on the Continent of Europe.

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FROM this it will be seen that Mr. Smith has prepared a most comprehensive programme, and we feel sure that the agricultural industry of the Transvaal and the Department of Agriculture will be greatly benefited by his investigations. Mr. C. E. Gray, M.R.C.V.S., Principal Veterinary Surgeon, has been appointed Acting Director of Agriculture during Mr. Smith's absence.

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THE annual report of the Department of Agriculture for the year 1906-07 has been issued, and may be obtained on application to the Government Printer. This valuable and comprehensive volume consists of over 450 pages, contains several maps and plates, and discusses the work and scope ot the different divisions. Regarding agricultural shows the Director—Mr. F. B. Smith—makes the following remarks, which are worthy of careful note by the various committees, judges, and exhibitors:—

"Nearly all the local agricultural societies held shows during the year, as also did several poultry and horticultural societies. On the whole there was an improvement in the management of the shows and in the quality of the exhibits, though many of the shows still have their weak points and are not so conveniently arranged or as stimulating and instructive as they ought to be.

"The majority of the show grounds are so big and the exhibits so scattered that a tour round the ground in a blazing sun is a very exhausting business, and every effort should be made to arrange the exhibits as compactly as possible, and to provide shade trees along the walks and at other points. The difference between a well-designed show ground and the pieces of bare veld with a few buildings erected upon them, which frequently do duty for show grounds, is immense.

"The compilation of the catalogues, the penning of the various classes of animals, and the arrangements for judging and inspecting the animals were often not as good as they should be, and though more care was discernible in the selection and preparation of animals

for exhibition, there is still room for improvement. If an animal is worth sending to a show it is worth a little trouble in the way of cleaning and handling so that it may be seen to advantage, and not to accord it that attention argues a lack of interest or want of knowledge. On the whole, the judging at the shows was better than in previous years, but it is still unequal, and it not infrequently happens that persons are appointed as judges who have little more than a nodding acquaintance with the animals they are expected to judge, and who have never kept them nor studied their points nor the requirements of the public in respect to them.

"It would also be well if the judges would be stricter in the discarding of undeserving animals. It would be an excellent thing if the Department were to retain or subsidise a number of judges to officiate at the various shows in order to make certain that the judging was sound and also to hold classes for instruction in judging similar to those held in the United States of America. As it is, the Department does what it can to provide judges, and there are few, if any, shows held without one or more member of the staff acting as such, but it is not yet doing enough."

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SPEAKING of the late Dr. Adam Jameson, Commissioner of Lands for the Transvaal (1903-07), Mr. Smith remarks:—

"Although he had severed his connection with the Department, it is impossible to close these remarks without a brief mention of the services which were rendered to it by the late Dr. Adam Jameson, who, as Commissioner of Lands under the Crown Colony Government, was the executive head of the Department, and to the universal sorrow that was felt at his tragic death, which occurred as he was leaving the Colony for England. Dr. Jameson was a highly-cultured man, and, in addition to possessing a wide knowledge of natural science and a philosophical turn of mind, was a shrewd adviser, and a considerate and inspiring chief.

"His memory will always be cherished by those who were privileged to enjoy his friendship."

AMONGST the many schemes which have been devised to aid the agricultural industry in the Transvaal we know of none which is likely to exercise a more profound influence on the future of our Colony than that which appears under Government Notice No. 734 of 7th August, 1908, and reads as follows:—

"Applications are invited for eight scholarships which have been provided for the training of lads from this Colony in agricultural or veterinary science at such agricultural colleges in Canada and the United States of America, or elsewhere, as may be decided upon later.

"The scholarships are of the annual value of £200, and will extend over a period of from two to four years according to the nature of the course undertaken.

"Applicants must be at least sixteen years of age, must hold the certificate of the matriculation examination of the Cape University, or any other equivalent examination, and have some

practical knowledge of ordinary farm operations, such as ploughing, harrowing, management of stock, etc. Further, they must produce satisfactory evidence as to moral character, physical health and strength, and intention to settle in the Transvaal and to adopt agriculture or one of its branches, or veterinary science, as an occupation.

"Applications will only be received from persons resident in the Transvaal, or whose parents are Transvaalers.

"The continuation of the scholarships will depend upon the reports received from the Head of the College as to the progress made by, and behaviour of, the students. During vacation, the students will be expected to spend their time on a farm or undertake some work of a practical character, so as to familiarise themselves with farming operations."

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THE colleges at which the Government scholars will pursue their studies are:—The Royal Veterinary College, London; the New York State College of Agriculture at Cornell, Ithaca, New York; the Iowa Agricultural College, Ames, Iowa; the Ontario Agricultural College, Guelph, Canada.

The following is the list of successful candidates:—

J. H. Neethling	Lydenburg.
G. J. Bosman	Wolmaransstad.
H. Reinecke	Middelburg.
Roy H. C. Lucas	Johannesburg.
P. R. Viljoen	Krugersdorp.
E. J. van Meerten	Pretoria.
A. M. Bosman	Pretoria.
J. C. Faure	Pretoria.

In the name of the farmers of the Transvaal and the Director and Staff of the Agricultural Department we offer our heartiest congratulation to our Government scholars, and can assure them that their careers will be watched with an ardent and patriotic interest.

SINCE the publication of the July issue of this *Journal* a forecast has been compiled regarding the areas in which the eggs of the brown locust have been laid in the Transvaal, and extensive preparations have also been made for a campaign against the voetgangers upon the commencement of the first heavy rains. Much aid has been received from the field cornets, the police, and farmers in connection with the reporting of the areas in which eggs have been laid. Large supplies of arsenite of soda and sugar, water drums, and other necessary material have been stored in the districts in which the voetgangers are expected to appear, so that the Division of Entomology is fully prepared for any emergencies which may arise. Thousands of post cards have been distributed amongst the farmers and other people, but we would again earnestly request that reports of *oviposition*, and the appearance of voetgangers should be promptly reported, as it is only by such means that the Entomologist is enabled to make a fairly accurate forecast.

REGARDING silk worm experiments, it is likewise the intention of the Division of Entomology, during the coming season, to conduct further experiments in sericulture, in order to obtain more accurate information regarding the acclimatisation of worms produced from imported eggs, and to encourage the farming community to take up this industry. In this connection arrangements have been entered into with the Conservator of Forests for the supply of 100,000 cuttings of the white mulberry tree (*Moras alba*), cuttings of which can be procured through the Division of Forestry at a cost of 10s. per 1,000. Microscopically examined eggs have again been ordered from France this year, and are expected shortly. These eggs can be obtained in small quantities on application to the Government Entomologist.

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TOUCHING fruit and plant inspection work, during the month of July over sixty consignments of Natal citrus fruit were condemned at Johannesburg, Pretoria, and Germiston, on account of having been infested with scale insects. Some trouble has lately been experienced in connection with the return of these consignments of condemned citrus fruit to Natal. The first arrangement was that our fruit importers should telegraph to the Natal Entomologist regarding the return of every consignment of condemned fruit. As the Plant Inspector frequently received requests to return such condemned fruit after a fortnight had elapsed, and as a single consignment might consist of from one to one hundred cases, the question of storage accommodation proved to be of importance. We have now entered into an agreement with the Natal Government to the effect that consignments of condemned fruit can be returned to the forwarding railway stations without obtaining the permission of their Entomologist in every instance. If such fruit is not reconsigned within three days from the date of condemnation it is destroyed. Our fruit importers have been circularised to this effect, and this arrangement has greatly facilitated the work of inspection, and has also prevented friction from occurring.

A SHORT time ago the Cape Entomologist requested particulars of condemned consignments of fruit sent from Cape Colony to the Transvaal. These were duly forwarded, and a list of growers whose fruit was returned or destroyed is published in the August issue of the *Cape Agricultural Journal*. For the information of Transvaal fruit-growers it may be stated during the Cape season—1907-08—the Plant Inspector at Johannesburg rejected 2,061 packages of diseased fruit sent up from Cape Colony, of which number 672 were reconsigned and 1,389 destroyed.

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IT is gratifying to note that several of our agriculturists are taking to ostrich farming, prominent amongst whom is the Hon. Johann Rissik, M.L.A., Minister of Lands. Mr. Rissik is an ardent believer in the potentialities of this industry, as well as in the suitability of the Transvaal climate. His farm at Zandfontein, some seven miles from Warmbaths, in the district of Waterberg, comprises a portion

of the famous Springbok Flats, and has an area of 10,000 morgen, 1,000 of which is now being farmed and divided into camps for the birds. The manager, Mr. John C. Gilfillan, has been for many years connected with the ostrich industry, and it is of interest to recall that his grandfather—Captain Heathcote—was one of the first colonists to start ostrich farming in 1869, in the Colesberg District, curiously enough importing—while on different shooting expeditions—wild birds to the Cape from that part of the Transvaal in which his grandson is now engaged in farming.

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MR. GILFILLAN, however, does not believe in having anything more to do with the wild bird because, as he points out, the Cape farmers have already brought up their birds to such a high standard of perfection by careful mating and selection that to begin all over again would mean a great loss of time and deterioration in the quality of the feather. At the same time judicious introduction of wild blood would probably have an invigorating effect on the constitution of the bird. A little over two years ago Mr. Gilfillan brought up some breeding birds and chicks from Cape Colony. Some of his cock birds are sons of the famous "Prince," for which the sum of 500 guineas was refused. Speaking of high prices it is worth remembering that the birds "Record" and his mate were bought by Mr. Bloomfield in 1904 for the magnificent sum of 1,000 guineas.

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AT Zandfontein the breeding birds—two hens and one cock—are placed in a paddock 200 yards square, and careful note is taken that male and female feathers balance each other. The male bird may *nick* up a weak point in the female, and so get away from the enfeebling effects of inbreeding. Those birds are isolated in April from the rest of the flock. Concerning feeding—In the morning each bird gets 3 lbs. of mealies daily, and later some green feed; also chaffed up lucerne or green barley—half a muid for each paddock. Failing that, the American aloe or the prickly pear leaves (kaalblad), which are practically spineless. In any case, the prickles may be singed off. Mr. Gilfillan states that it is not absolutely necessary to have lucerne paddocks except, perhaps, a little patch for the small chicks, but mealies are essential.

The season of plucking varies greatly, and tests must yet be made to determine the best period, but the bird should be in full plumage during the dry winter months, and the plucking should take place just as the first rains fall in spring. Prices at the last Port Elizabeth show were at the rate of £79 per lb. for prime white feathers. A good bird ready for plucking will average from £6 to £10 per bird per year. Mr. Gilfillan's young birds averaged £5 the last plucking, and they will naturally improve for two years to come. Plucking begins at the age of nine to ten months; whilst the first payable returns realise from £3 to £4 per bird.

Those of our readers who propose starting ostrich farming could not do better than to pay a visit to Zandfontein, where they will find in Mr. Gilfillan not only an enthusiastic and competent ostrich farmer, but one who most generously places his wide experience at the disposal of all those who may be interested in this branch of farming.

Sir Percy Fitzpatrick, M.L.A., has kindly forwarded to us two reports on a bale of 300 lbs. of wool with which he gained a first prize at the last Harrismith Agricultural Show and afterwards sent to England. This wool was clipped from sheep bred in the Harrismith District, and we are sure all our farmers will congratulate Sir Percy on the highly encouraging returns he got from two well-known wool experts.

Mr. J. R. Raper, managing director of Isaac Holder & Sons, the largest wool-combers in the world, of Alston Works, Bradford, writes:—

"I enclose the result of the little lot of Cape wool which we have been testing for you. We have had a large experience in combing Cape wools this season, having combed many thousand bales. I consider this lot to be the finest we have seen for length and style. The yield is also much better than the average. I am glad we have had the opportunity of testing this lot."

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Mr. H. Dawson & Co., Portland House, London, writes:—

"The wool is *excellent* in quality, breed, and staple. Such wool is keenly competed for at prices which in actual *clean weight* is well on a par with good Australians. It is becoming increasingly valuable when long stapled, because of its fine spinning properties and usefulness for the lace trade as well as for fine thin worsteds for summer wear. The condition is *good* for South African produce, although we have seen lighter wools from Kaffraria. There is, however, a little more earth in it than there should be for such choice wool. If the yield (which would probably be 44 to 45 per cent. on this bale) could be brought up to a 48 per cent. condition by a little care, then it would always be available for the American buyers at an appreciation of 1d. to 1½d. per lb. on the 45 per cent. basis."

* * * *

A most encouraging report on the quality of South African wools has been received by Messrs. Stark & McClymont, P.O. Box 3077, Johannesburg. The following remarks occur in a letter received by Messrs. Henderson & Co., hosiery manufacturers, Hawick, Scotland, from their spinners, reporting upon South African wool:—

"Gentlemen,—In response to your enquiry regarding our experience of South African wools we beg to state we have noticed a marked improvement within the last few years, especially in the greasy combing-wools, and we now conisder that they produce a tweed cloth yarn equal to that made out of Australian wools. South African wools are also freer from burr than Australian, although we would like to see still more attention paid to this matter, as these burrs injure the goods very seriously. For hosiery purposes we also consider that they are more suitable, and produce a fabric of the finest texture that will give entire satisfaction."

* * * *

Mr. T. M. Cullinan, M.L.A., when on a visit to Rhodesia the other day, kindly undertook to enquire into tobacco growing. He writes us as follows:—

"While visiting Rhodesia, and having heard that their tobacco had made a good name for itself, and was much sought after for the manufacture of cigarettes, I thought that being on the Tobacco

Commission I would have a look at the Salisbury factory, and now send you herewith a resumé of what information I was able to obtain.

* * * *

"The first thing that struck me in travelling through the country was that the tobacco plants did not seem to grow so luxuriantly as they do in the Transvaal, and that the tobacco gardens were mostly on sandy soil that had been formed from the decomposition of granite, and therefore not what you would call a rich soil. There is always, however, on places cleared of the trees sufficient decayed vegetable matter to give this class of soil, for the first few years, certain properties that may be good for tobacco growing. But I anticipate that some scientific researches will have to be made to find out the class of manure which will be required. When I say the plants do not grow as luxuriantly as in the Transvaal, I may be wrong, not being familiar with the growth of the same type of tobacco when grown in the Transvaal.

"On visiting the Government warehouse at Salisbury the manager explained to me that the soil around Bulawayo was better adapted for Turkish seed, and that around Salisbury for the Virginian seed. The tobacco is all flue-cured by the farmers, and is received baled in leaf from different parts of the country, done up in neat packages with strong wrappers to prevent the contents being damaged by travelling. The bales are then opened in the curing-room, the atmosphere of which is kept moist with steam, and when the tobacco is sufficiently pliable to be handled without breaking it is carefully classified and put into bales, and pressed ready for the market. The Government then send samples of the tobacco to the different manufacturers, who send in tenders for the various classes most suitable to their special requirements. This method, I believe, has been very successful, as much as 3s. per lb. being obtained for their best leaf.

"I attribute a great deal of the success of the growing of tobacco in Rhodesia to the fact that there were no prejudices to overcome, and that the farmers were not old tobacco growers, like those in the Transvaal, who had been accustomed for the past fifty years to producing pipe tobacco, and that when the farmers in Rhodesia were instructed in this special way they worked on the lines laid down by the Government specialist, and thus were able to produce the tobacco more universally in demand. I feel strongly convinced that the objection raised by some of the members of our Commission that we could not get our farmers to pack tobacco so that it would stand the rail journey from the different parts of the Transvaal to a central establishment in Pretoria is wrong, and if we can get the farmers to listen to our experts we will be able to educate them up to growing tobacco, which will be adaptable to the requirements of the greater market. I feel all the more certain that they will be willing to act on the advice of our experts, seeing that the growth of the ordinary Transvaal tobacco for pipe use is considerably overdone, and does not bring a price which pays for production.

"The success of the tobacco industry in Rhodesia has been attained through the help that the Government extended to the farmers in the initial stages of the industry by pointing out the seed best adapted to certain soils, and instructing them in the way the tobacco should be grown and packed."

The first report of the Committee appointed to advise the Government in regard to the best method of developing the tobacco industry of the Transvaal has been issued, and should be read by all interested in the industry.

The report is signed by the following members: **Messrs. F. B. Smith,** *chairman;* **H. A. Baily, T. M. Cullinan, L. J. Jacobsz, C. A. Madge, H. Mentz, J. J. Munnik, and E. N. Cresswell,** ***hon. secretary.*** Owing to the absence from the Colony Mr. Abe Bailey, M.L.A., was unable to attend the meeting of the Committee, at which the report was considered, though until that date he took an active part in its deliberation.

The Committee recommend:—

1. That the work performed by the Department of Agriculture, on behalf of the tobacco industry, be supplemented and extended.

2. That a properly equipped experiment training station, dealing mainly with tobacco, but possibly including other branches of sub-tropical agriculture, be established.

3. That financial encouragement be given to allow of young men to study the science and art of tobacco growing at some approved centre.

4. That, in addition to the experiment stations now established at Rustenburg and Barberton, experiment stations be established in the Zoutpansberg and Piet Retief Districts.

5. That, in addition to the employment of such specialists in the various branches of the industry as may be required by the Department of Agriculture, either in Pretoria or at the experimental stations, four or five men, with experience in tobacco growing, be engaged as itinerant instructors: these men to be stationed in the chief tobacco-growing districts, and their duties to be to visit the farmers and show them how to select seed, prepare seed beds, cultivate tobacco in the field, harvest it, etc

6. That instruction be given in approved methods of drying and curing tobacco and, if necessary, that model flue-curing and other sheds be erected.

7. That steps be taken to organise the farmers and to establish one or more warehouses in which tobacco could be received from the farmers and graded, treated and baled, and eventually disposed of by auction or by tender. The Committee is of opinion that as far as possible farmers should be encouraged to co-operate and to undertake this work themselves, and that the Government should confine itself to advising the farmers and to granting, through the Land Bank, loans according to the regulations of this Institution: but if difficulty be experienced in getting the farmers to embark upon such an enterprise, the Committee thinks the Government should establish a warehouse which, if successful, would act as a model, and which might later on be transferred to a Co-operative Society.

8. That the Government assist the farmers by raising and distributing approved seed.

9. That the practice of giving prizes at agricultural shows for small quantities of leaf be discontinued, and substantial prizes offered

Plate 20.

A Modern Cow Barn on the Farm "Eben-Haezer,"

Owned by Mr. H. A. Dyksterhuis, Villeria, near Pretoria.

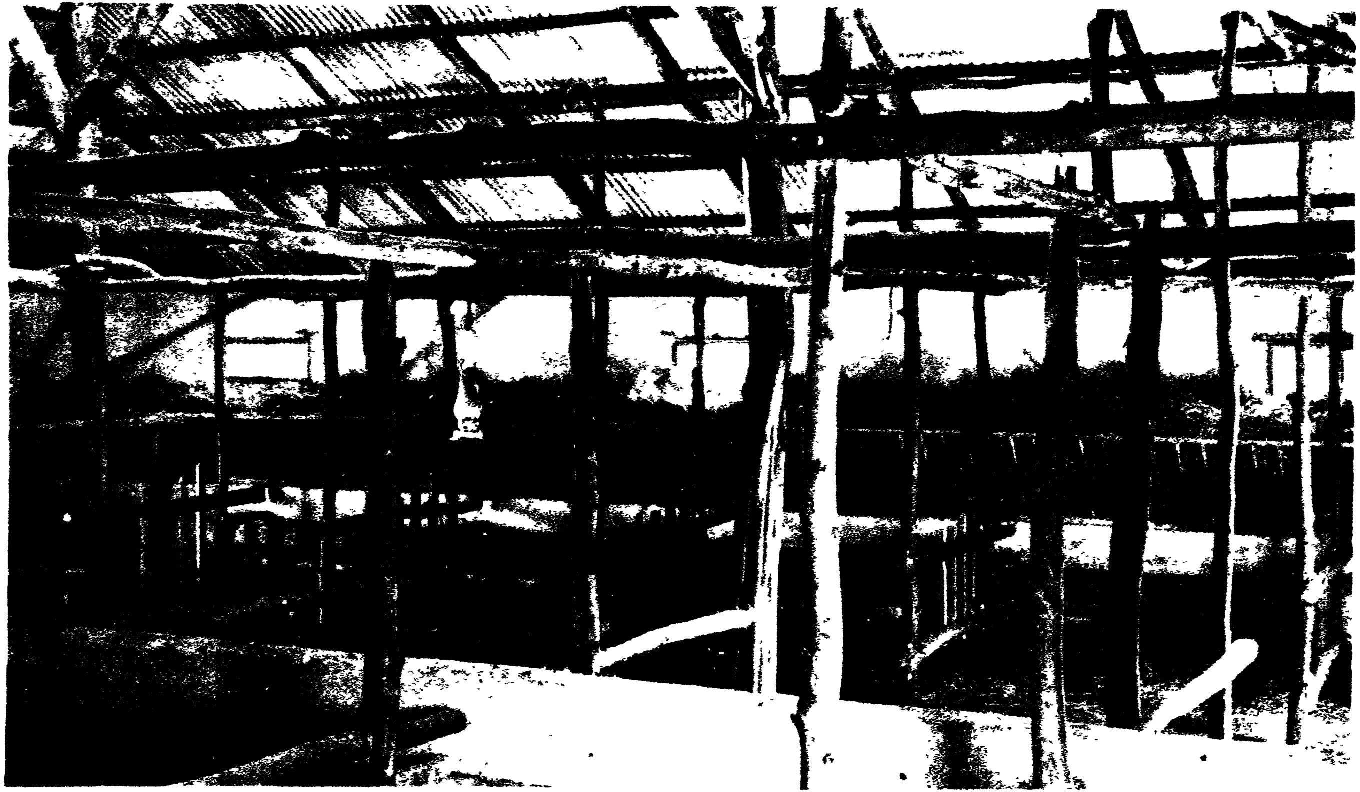


Plate 21.

Interior of Cow Shed on the Farm "Eben-Haezer," Villeria, near Pretoria.

Showing woodwork made entirely of local grown timber.

for the production of a considerable quantity of tobacco of uniform quality.

10. That some system of inspection of tobacco be instituted so as to prevent adulteration, misrepresentation as to origin, and other fraudulent or misleading practices in connection with manufactured tobacco.

* * * *

An epoch-making report has recently been issued by the Transvaal Indigency Commission appointed by the Government to enquire into the conditions of indigency existing amongst persons of European nationality in the Transvaal, which should be studied by every one interested in the uplifting of our Colony. It is impossible to touch upon the various points of interest dealt with by the Commission, and we must content ourselves by giving a brief summary of this Blue book.

* * * *

The Commissioners state that there are two root causes of indigency in the Transvaal. The first is aversion to manual labour, and the second the primitive tradition of a great part of the farming class, and the fixed idea that every countryman must own land. No cure for indigency which neglects these two fundamental causes can really be effective. It may relieve distress in one quarter, but it will produce no appreciable result on the problem as a whole. Poverty will remain and will grow worse so long as the white man continues to regard manual labour as beneath him, and to remain content with the traditional methods of dealing with the land. The rest of South Africa is suffering from the same trouble, and indigency can only be rooted out if the whole of South Africa co-operates in changing the ideas and traditions of the past which have dominated it for so long.

Settlement is not for indigents, and the solution of the problem of rural indigency is to be found in the development of the system of tenant farming and the rise of a white agricultural labouring class.

* * * *

That the dairy industry is beginning to prosper will be plainly seen from Plates 20, 21, and 22 in the current issue. These illustrations show the cow barn of Mr. H. A. Dyksterhuis on his farm "Eben-Haezer" in Villieria, near Pretoria. This cattle shed, which is designed to hold 48 cows, is noteworthy for the fact that all the woodwork is made from Transvaal trees, planted by Mr. Dyksterhuis some twelve years ago.

Plate No. 20 shows the outside of the building. Care has been taken to provide a good ventilation, which prevents the temperature in the shed from becoming too high at any time. With a hot sun shining on the outside, and the warmth of the cows in the shed, the temperature is bound to rise quickly, and should therefore be lowered by continual ventilation. During the day the milch cows remain on the veld, towards evening they are brought inside to be milked, and in the morning after the milking they are allowed out again. The milking always takes place in the stable, and this is a great improvement compared with the too common practice of milking in the kraal.

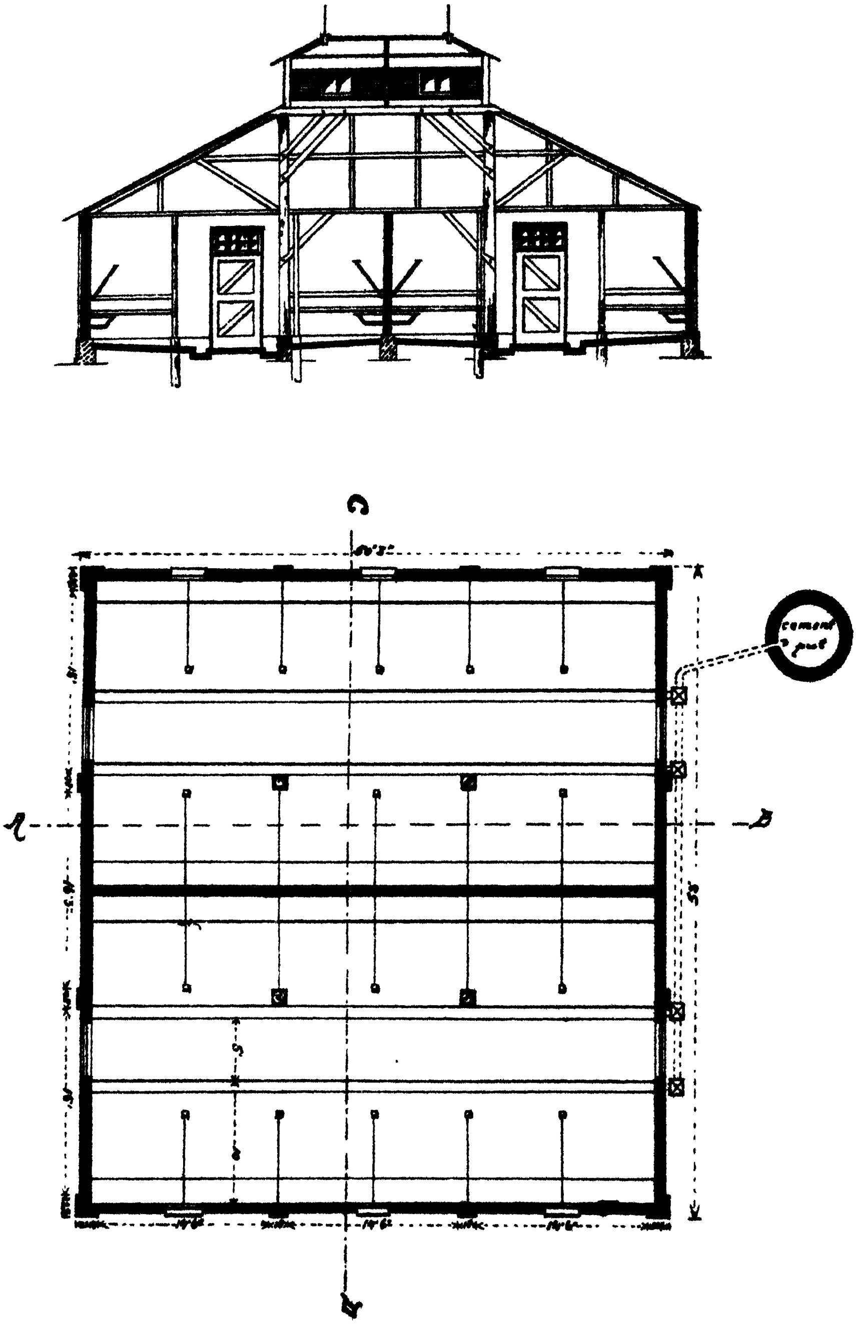


Plate 22.

Plan of Cow-barn

On the Farm "Eben-Haezer," Villeria, Pretoria.

IN the process of the rotting of manure in the ordinary kraal, a layer of dung is gradually formed, several inches high, which dries up and rises in the form of a fine dung-dust. During milking this dust is very liable to get into the milk pails, and so injuriously infect the milk. In the shed illustrated this does not occur. The cement floor makes the cleaning easy, and as the animals are outside during the day the floor can be kept clean and fresh. Before milking takes place the cows are thoroughly washed. As there are no trees on the farm, Mr. Dykersterhuis intends stabling his cows during the hottest hours of the day in summer. Plate No. 22 represents the plan of the shed with all the details of the construction. We must compliment Mr. Dyksterhuis and his architect, Mr. Meyer, on the step they have taken in erecting a cow-shed which should serve as an example to all farmers in the Transvaal who intend going in for the dairy business on up-to-date lines.

* * * *

WE cordially welcome the first number of the *Agricultural Journal* of British East Africa, which is issued by the Agricultural Department at Nairobi. This bright little quarterly is edited by the Director of Agriculture, Mr. A. C. Macdonald, assisted by the staff of the Agricultural Department. Amongst others we note the following articles: Sisal Hemp, Pleuro Pneumonia, Sheep-breeding, Notes on Cotton, Tree Cotton, Ceara Rubber, Coffee Disease, etc. The Transvaal farmer would envy the table of rainfall records, which shows at least three districts with an annual average rainfall of over 60 inches; although we observe that Mwatate has only 13.

The *Journal* is supplied free of charge to all owners and occupiers of land in the Protectorate. To all other persons the annual subscription is Rs.4 (5s. 4d.), which includes the postage.

It is probably outside the province of a Government agricultural organ to discuss the matter of coinage, but it does seem a pity that the Protectorate is saddled with the Indian system of coinage which, however much used in the Orient, is but little understood in the agricultural markets of Europe, and can hardly fail to cause confusion in dealing with other British States in Africa.

* * * *

THE Government Botanist, Mr. J. Burtt-Davy, calls attention to the fact that when co-operative experiment seeds are returned to the Department it is often difficult to determine from whom they come, owing to the numbers which are received. Farmers are therefore earnestly requested, when sending parcels of seed to the Government Botanist, to either write their name across the bags or else to place a ticket in the mouth of the bag, giving the name of the variety and *stating by whom it was grown.*

When reporting on the success or failure of the experiments by *letter* instead of on the printed forms supplied for the purpose, farmers are asked to mention each variety by name: by so doing they will spare us a large amount of unnecessary work which is now entailed in tracing the different varieties when the report simply refers to "the seeds sent." As there are about eight hundred farmers carrying on experiments in co-operation with the Division of Botany, the difficulty experienced in tracing unlabelled lots of seed will at once be apparent.

Mr. Robert Farrell, Box 1573, Johannesburg, writes us as follows:—

"'I am in receipt of letters inquiring about maize or mealies for export from two well-known merchants in Sydney, New South Wales. They say: 'Several shipments came across here and have turned out satisfactorily. We shall be glad to have your quotation c.i.f. for specified quality and quantity, say, 200 to 500 ton lots. The quality must be prime, dry, yellow, fit to ship and carry, and the package must be strong calcutta sacks. We are prepared to establish letters of credit or accept sight drafts against shipments.'"

Another writes:—

"Mealies we can do with, say, the beginning of the New Year, from 500 to 1,000 tons of your best yellow flat mealies, all things being satisfactory, regularity, soundness, full weights, properly packed in new sacks, and, on receipt of samples and acceptance, are prepared to put up letters of credit covering the same. *Oats*, Cape and Cape Tartary, we can do with any time now on the same conditions as above."

For those of our readers who are interested in the subject of land settlement in South Africa, it may be of interest to quote the terms, taken from the *London Times*, under which land is now being offered to settlers by the British South Africa Company. A settler may either purchase land outright for cash subject to the fulfilment of an easy occupation condition, or purchase land and pay for it by instalments spread over a period of ten years, or may become a tenant of the Company with the option of purchase, paying a rental calculated at 5 per cent. upon the purchase price, which is fixed by agreement at the beginning of the tenancy. The purchase price includes survey fees and all other charges. A rebate is given for the erection of fencing or live hedges, for the planting of forest or fruit trees, and for general cultivation of a *minimum* area of land. The Board has also decided to grant ranching leases of large areas upon terms similar to those which have proved so successful in Australia. The price of unimproved land in Rhodesia is 9d. to 4s. an acre, the former price being for ranching land. Irrigable land suitable for intensive cultivation naturally commands a higher price. Arrangements have also been concluded whereby settlers entering the country will be granted free conveyance over the Rhodesia railways, while half-rates are granted for live stock and implements.

* * * *

We would like to call the attention of our farmers to an ingenious patent wire strainer which seems to us to possess the merit of both simplicity and durability. With this implement it is possible to strain wires in new or old fences very rapidly. The agent—Mr. J. E. Montgomerie—gave a demonstration at the last Witwatersrand Agricultural Show, mending and tying a wire knot in 35 seconds. Most farmers, however, use barbed wire, and a wire strainer can hardly be an entire success unless it is able to deal with both sorts of wire with equal facility. This strainer has been patented by Messrs. D. Donald & Sons, North Island, New Zealand, and can be purchased for 27s., post free, from Mr. Montgomerie, Standerton.

OUR farmers will be interested to learn that the Transvaal has recently had a visit from Mr. D. R. Redler, General Manager of the Kaffrarian Steam Mill Co., Ltd., Kingwilliamstown, who has been looking into the possibilities of this part of South Africa as a wheat-producing region. Mr. Redler appears to be very favourably impressed with the prospects of growing this cereal upon a large scale.

IN view of the possibility of the introduction of contagious diseases, the Right Hon. the Minister of Agriculture has decided that, in future, no more animals will be received from the public upon any of the Experimental or Stud Farms for stud purposes.

OUR readers often enquire as to the possibility of getting their *Journals* bound. We are glad to be able to announce that the four numbers of any year will be bound in green cloth for the moderate sum of 6s. 6d. by Messrs. Wallach & Co., P.O. Box 389, Pretoria.

THE Assistant Horticulturist, Government Experimental Orchard, Potchefstroom, has a quantity of teff seed for sale at 1s. per lb.

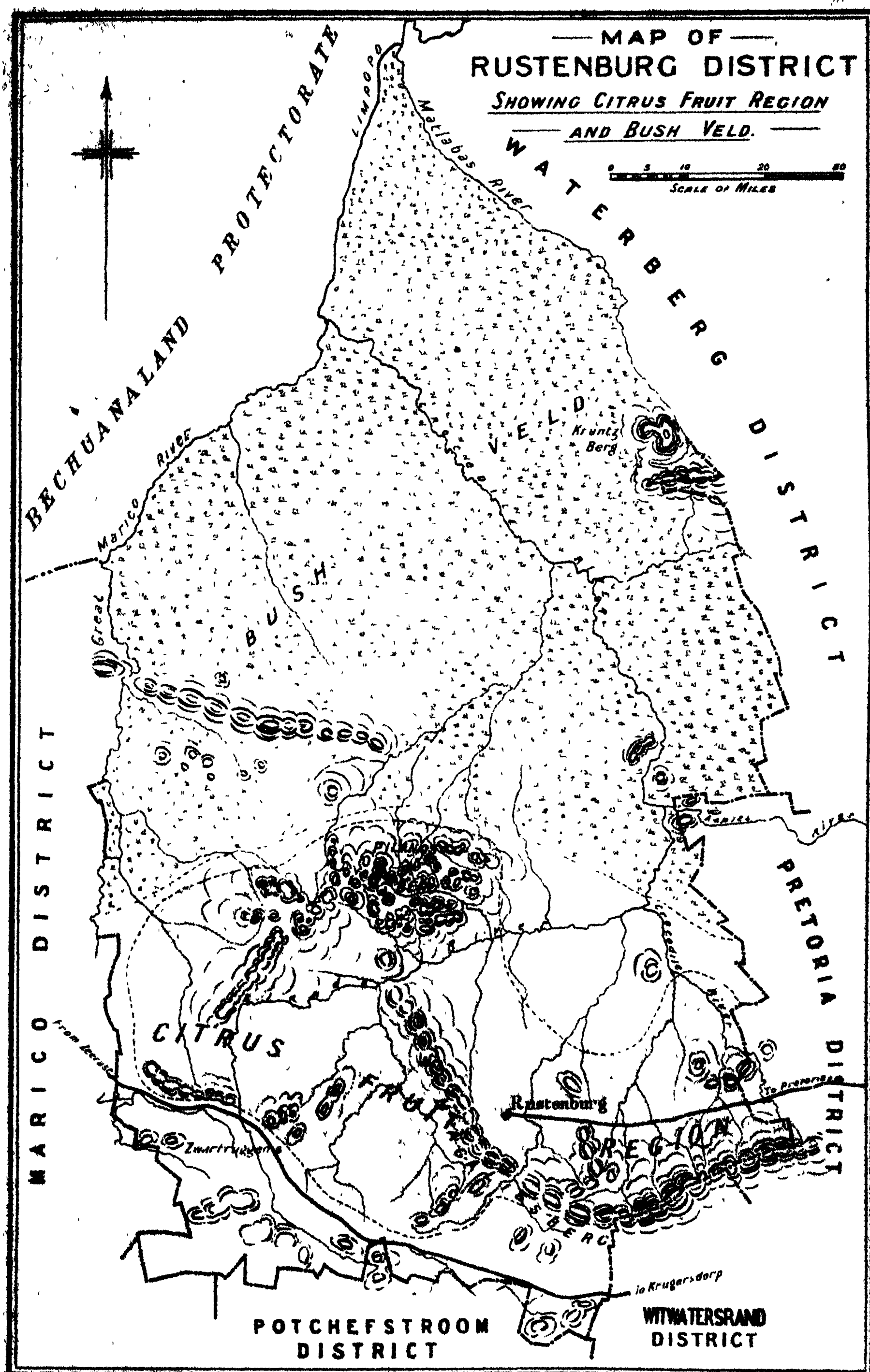
THOSE farmers who are interested in Forestry can now obtain Farmers' Bulletin No. 8. on "The Propagation of Trees from Seed," free of charge, on application to the Government Printer, Pretoria.

UNDER the title of "Agricultural South Africa" the *Cape Times* has issued an interesting annual devoted to the promotion of agriculture and stockbreeding throughout South Africa. The useful volume is well printed, profusely illustrated, and is a credit both to the compiler (Mr. B. M. Hart) and the publishers. There are many valuable articles by farmers and Government officials, and the modest price—one shilling—should ensure its ready sale in the Transvaal.

AT the recent Transvaal Union Conference held in Pretoria the dates for the Agricultural Shows in 1909 were provisionally fixed as follows:—Lydenburg, last week in January; Ermelo, first week in February; Bethal, second week in February; Carolina, third week in February; Standerton, 24th March; Middelburg, first week in March; Wakkerstroom, last week in February; Heidelberg, 7th April; Johannesburg, 14th April; Pretoria, 21st April; Klerksdorp, 28th April; Wolmaransstad, 5th May; Barberton, July. It is understood that Potchefstroom and Pietersburg do not intend to hold shows next year.

READERS will be pleased to note that, in this issue, we have started the first of a series of articles on household science. Our object is—like that of our American and Canadian friends, who have long recognised the need of assisting women in their daily household duties—to try and help our farmers' wives; and, also, to teach our girls to take a greater pride in their home surroundings, and not to look upon housework merely as a tiresome task, but, in the sunshine of the latest science, as a really noble calling.

WE cordially invite readers to communicate with the Department of Agriculture on any subject pertaining to household matters upon which they may wish to receive advice. Any practical suggestions or contributions to the Household Science column will be gladly received and duly acknowledged.



Compiled in the Surveyor General's Office Pretoria. August 1908

Plate 24.

Interior of a Natural Forest.

Zoutpansberg District.

Agricultural Notices.

Veterinary Division.

ARRANGEMENTS FOR FORWARDING PATHOLOGICAL SPECIMENS.

It is hereby notified for general information that special arrangements have been made with the Central South African Railways for forwarding pathological specimens for examination in the Veterinary Bacteriological Laboratory, and all such specimens can now be sent carriage forward, if addressed to the Government Veterinary Bacteriologist, Pretoria Station, and distinctly labelled "Scientific Specimens for Examination." The Government Veterinary Bacteriologist is at all times glad to make examinations and to report on pathological specimens, but farmers and others sending such are earnestly requested to write full particulars of the animal from which the specimen has been taken and to post such in time to be delivered before the arrival of the specimen, or, in case of urgency, to telegraph. The importance of doing this is urged since occasionally, when not previously advised, specimens have arrived in too decomposed a condition for examination.

F. B. SMITH,
Director of Agriculture.

Office of the Director of Agriculture,
1st October, 1907.

* * * *

SPONZIEKTE OR QUARTER EVIL.

Vaccine for the prevention of this disease is now ready for issue at the Government Veterinary Bacteriological Laboratory, and can be obtained through the Government Veterinary Surgeons, who will give instruction in the method of vaccination, and through whom also the necessary instruments can be obtained. The price of the vaccine is 3d. per double dose.

* * * *

WARNING TO IMPORTERS.

The attention of the Department has been directed to the fact that certain imported cattle brought into this country under certificates stating that they have been tested with Tuberculin before shipment and have passed the test satisfactorily, have been found to react as infected when re-tested by the Government Veterinary Staff shortly after arrival. For this reason it is suggested that importers of cattle should have such imported animals re-tested by a Government Veterinary Surgeon on arrival at their destination, and before they are allowed to mix with other stock. Should anyone wish to take this precaution the test will be applied free of charge upon application to the Government Veterinary Surgeon of the District to which the cattle are taken, at the earliest convenience of this Officer to whom the application is made.

F. B. SMITH,
Director of Agriculture.

* * * *

PORTS FOR ENTRY OF STOCK.

The following are the ports for entry of stock into this Colony from the neighbouring territories:

	Days on which open for examination of Stock.
Vereeniging	Daily.
Volksrust	..
Villiers Drift	..
Christiana	..
Roberts' Drift	Thursdays, Fridays, and Saturdays.
Schoeman's Drift	Mondays and Thursdays.
Buhrman's Drift	Saturdays.
Fourteen Streams	Wednesdays.
Coal Mine Drift	Thursdays.
Mosymiani	Saturdays.
De Lange's Drift	Tuesdays.
Commando Drift	Alternate Wednesdays.
Komati Poort, through which stock not provided for under Clause 5, Government Notice No. 834 of 1903, will only be allowed to proceed by rail, to be examined at Machadodorp	Portuguese East Africa.

Division of Chemistry.

SCHEDULE OF CHARGES FOR ANALYSIS MADE IN THE AGRICULTURAL LABORATORIES.

	£	s.	d.
1. Estimation of one constituent in a manure or feeding stuff ..	0	7	6
2. Estimation of two or three constituents in a manure or feeding stuff	0	15	0
3. Complete analysis and valuation of a manure or feeding stuff ..	1	0	0
4. Analysis of water—drainage or irrigation	1	5	0
5. Partial analysis of a soil to determine fertility and manurial needs	2	0	0
6. Complete analysis of a soil	3	0	0
7. Analysis of milk, cream, butter, or cheese	0	10	0
8. Milk—determination of fat and total solids	0	5	0
9. Milk—determination of fat only	0	2	6
10. Butter—determination of water and fat	0	5	0
11. Analysis of a vegetable product—hay, ensilage, roots, etc.	1	0	0

At present no charge will be made to *bona fide* farmers. The charges in the above schedule refer to products sent by manure merchants, milk dealers, or others interested in trade. Samples will only be accepted if assurance can be given that they are properly taken and truly representative of the bulk. The right of publishing the results of any analysis is reserved by the Department. Should the examination of any product furnish results which are deemed of sufficient general interest, the charges may be remitted.

Samples of any product likely to be of agricultural importance will gladly be received.

Division of Botany.

INJURIOUS WEEDS.

Owing to the fact that of late several newly-introduced and injurious weeds have made their appearance in the Transvaal, farmers are earnestly requested to take careful notice of any new plants which have appeared on their farms and which seem to have a tendency to spread. When such are discovered, specimens of the plant bearing flowers and, if possible, fruit should be forwarded to the Government Botanist by whom they will be examined and reported upon. They should be forwarded in the same way as specimens of poisonous plants.

COCKLE-BURR.

On account of the dangerous character of this weed to wool and mohair growers, farmers on the Aapjes, Pienaars, and Crocodile Rivers are advised to keep a sharp look-out for its appearance, especially on the banks of the rivers, and to root out the plants before they scatter seed. Any farmer who is in doubt as to the identity of Cockle-Burr can send specimens to the Botanist for identification.

Division of Forestry.

SALE OF HEDGING FROM IRENE NURSERY.

It is hereby notified for general information that the sale of Hedge Plants from Irene Government Nursery has been discontinued. Forest trees will be disposed of as formerly.

The price list of seeds and trees supplied by this Division can be obtained free of charge on application to the Conservator of Forests or the Government Printer, Pretoria.

Farmers' Bulletin No. 8, "The Propagation of Trees from Seed," can now be obtained, free of charge, on application to the Government Printer.

Division of Horticulture.

CONTINUATION OF NURSERY WORK BY THE HORTICULTURAL DIVISION.

The present opportunity is taken of notifying farmers generally that the propagation of young fruit trees for sale at the various Experimental Orchards and Nurseries of this Division will be recommenced immediately, but trees will not be available for disposal until July, 1909. By this date it is expected that a good number of trees will be available, and they will comprise such varieties as have proved to be suitable for the various districts of the Transvaal by actual test at the different Experiment Stations.

* * * *

SALE OF FRUIT TREES, VINES, CUTTINGS, SCIONS, ETC.

It is notified for public information that in future payment must be made for goods on or before delivery. When purchasers mention a railway station to which packages may be consigned for them, advantage may be taken of the "Collect on Delivery" system of the C.S.A.R. In all other cases cash should accompany the order, but it is advisable prior to remitting same that enquiries be made of the Government Horticulturist as to the ability of the Division to supply the trees ordered.

* * * *

The Assistant Horticulturist, Government Experimental Orchard, Potchefstroom, has a quantity of teff seed for sale, in good condition, at 1s. per lb.

Tobacco Division.

The Portuguese Consul, Pretoria, has kindly furnished particulars of the regulations to be observed when Transvaal grown leaf tobacco is imported into Portuguese East Africa from the Transvaal duty free. The regulations are here published for the guidance of tobacco growers :—

In towns where no Portuguese Consul is resident, it is sufficient if a Customs Officer makes a written declaration to the effect that the leaf was grown in the Transvaal.

If there be no Customs Officer, a form similar to the specimen appended hereto must be made out and signed by a Resident Magistrate or a Justice of the Peace. The form must then be forwarded to the Portuguese Consul, Pretoria, together with an amount of 4s. 6d. (cost of stamps). The Portugese Consul will issue a certificate allowing the leaf to enter Portuguese East Africa duty free ; this certificate will be sent to the consignee, or, if a stamped addressed envelope be enclosed, to the consignor.

A Bill of Export must also be prepared and forwarded to the consignee at the same time as the tobacco is despatched.

SPECIMEN FORM.

I (we), the undersigned, declare under oath that the following goods (quantity of cases or bags, marks, weight, value), forwarded this day to Mr........................ .... Lourenco Marques, are produce of the soil of the Transvaal.

(Date)..190

Sworn before me

(Signed)...

Resident Magistrate or Justice of the Peace.

Experimental Farm, Potchefstroom.

SEEDS FOR DISPOSAL.

Oats.—

Price 10s. per 100 lbs., f.o.r. Potchefstroom.

Varieties :—"White Egyptian" and "Algerian."

Sorghum (Saccharatum).—

Price 3d. per lb., f.o.r. Potchefstroom. Sow 12 to 15 lbs. per acre.

Broom Corn.—

Price 3d. per lb., f.o.r. Potchefstroom. Recommended for growing material required for making brooms. Sow about 8 lbs. per acre.

The quantity of these seeds which will be issued to any one farmer will be determined by the applications received, and allotment will be made according to priority of application. *Orders must be accompanied by cheque or postal order.* For full particulars and any other information apply to the General Manager, Experimental Farm, Potchefstroom.

ALEX. HOLM,
General Manager.

STOCK BIRDS AND SETTINGS OF EGGS FOR DISPOSAL.

Pekin Ducks and Drakes, price 12s. 6d. each f.o.r. Potchefstroom.

Bronze American Turkey Cocks, price 20s. each f.o.r. Potchefstroom.

Settings of eggs (12 to the setting) of the following breeds, price 11s. per setting f.o.r. Potchefstroom :—Anconas, Minorcas, White Leghorns, Black Leghorns, Brown Leghorns, White Wyandottes, Silver Wyandottes, Buff Orpingtons, Indian Game.

Breeding pens will be broken up at about the end of the year, after which eggs will not be available.

Ducks eggs of the following breeds, 15s. per setting f.o.r. Potchefstroom :—Aylesbury and Pekin. These will be available until about the end of the year.

Bronze American Turkey eggs 20s. per doz. f.o.r. Potchefstroom, available until the end of November.

A considerable number of young stock of the breeds mentioned above will be ready for disposal after 1st, January 1909, at prices ranging from 12s. 6d. to 15s. each f.o.r. Potchefstroom.

For further information and particulars apply :—

R. BOURLAY, *Poultry Expert*,
Experimental Farm, Potchefstroom.

Stud Farm, Standerton.

In view of the possibility of the introduction of contagious diseases the Rt. Hon. the Minister of Agriculture has decided that, in future, no more animals will be received from the public upon any of the Experimental or Stud Farms for stud purposes.

Editorial Division.

AVAILABLE PUBLICATIONS.

The following publications can be had, free of charge, on application to the Government Printer, Box 373, Pretoria :—

Transvaal Agricultural Journal, No. 3, Vol. I. (Published quarterly.)
" " " No. 4. Vol. I. " "
" " " No. 13, Vol. IV. " "
" " " No. 14, Vol IV. " "
" " " No. 15, Vol. IV. " "
" " " No. 16. Vol. IV. " "
" " " No. 21. Vol. VI. " "
" " " No. 22, Vol. VI. " "
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Division of Botany:

Leaflet No. 1.—"Plants Poisonous to Stock."
" No. 4. -"The Cockle-Burr."
" No. 6.—"Peach Leaf Curl."
Bulletin No. 1.—"The Conditions of Seed and Plant Distribution," 1906-7.
" No. 2. —"The Conditions of Seed and Plant Distribution," 1907-8
Circular No. 1.—"Poisonous Plants."

Division of Entomology:—

Leaflet No. 1.—"Cut Worms."
" No. 5.—"The Fowl Tick."
" No. 6.—"Cockchafers and Flower Beetles."
" No. 7.—"Sprays for Locust Destruction."
" No. 10.—"Notes on Termites."
" No. 11.—"The Scale Insects of Citrus Trees."

Division of Forestry:—

"Price List of Seeds and Trees."

Division of Horticulture:—

Bulletin No. 1.—"Some Information about Fruit Trees."
Leaflet No. 3.—"A Fruit Report."
" No. 4.—"Diseases of Orange Trees."

Division of Dairying:—

Leaflet No. 1.—"The Making of Full-Cream Gouda Cheese on a Dutch Farm."
Circular No. 1.—"Breakfast Cheese."
" No. 2. -"Rennet Making."
" No. 4.—"Treatment of Milk."
Farmers' Leaflet No. 1.—"Buttermaking."
" " No. 2.—"Making of Edam Cheese."

Division of Veterinary Science:—

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,, No. 6.—"Contagious Abortion."
Leaflet No. 3.—"Rhodesian Tick Fever."
,, No. 5.—"Glanders and Farcy."
,, No. 4.—"Directions for Preparing Blood Smears."
,, No. 6.—"Wire Worms."

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Bulletin No. 1.—"Burrweed or Boete Bosch."
,, No. 2.—"Some Diseases of the Horse."
,, No. 3.—"The Food of Plants."
,, No. 6.—"City and Town Milk Supply and the Care and Aeration of Milk.

Farmers' Bulletins:—

Farmers' Bulletin No. 1. "Maize Foods for the Home."
Farmers' Bulletin No. 2. "Notes on Tobacco."
Farmers' Bulletin No. 3. "Notes on Lucerne Growing."
Farmers' Bulletin No. 4. "Smut in Wheat, Barley, and Oats."
Farmers' Bulletin No. 5.—"Insect Enemies of Mealies in the Transvaal."
Farmers' Bulletin No. 6.—"How to secure Good Seed Maize."
Farmers' Bulletin No. 8.—"Propagation of Trees from Seed."
Farmers' Bulletin No. 9. "Notes on Transvaal Tobacco Pests."
Farmers' Bulletin No. 10.—"How to Produce Bright Tobaccos."
Farmers' Bulletin No. 11.—"Potato Scab."
Farmers' Bulletin No. 12.—"Black Rust on the Grape."
Farmers' Bulletin No. 13.—"Budding and Grafting."
Farmers' Bulletin No. 14.—"Modern Creamery Methods."

Miscellaneous:

Bulletin No. 3.—"The Brands Directory, 1906."
Annual Report of the Director of Agriculture for the year 1903-4.
,, ,, ,, ,, ,, 1904-5.
,, ,, ,, ,, ,, 1905-6.

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JOURNAL FILES.

In order that our numerous readers may not be disappointed by being unable to complete their files, we would earnestly request them to preserve all copies of the "Journal" if they propose to bind them at the close of the year. Owing to the expense incurred in publication, it has become necessary to limit the number of copies issued, and it often happens that we cannot supply back numbers, as they are out of print.

Indexes for the "Agricultural Journal," Vol. II., Vol. III., Vol. IV., Vol. V., and Vol. VI. can be had on application to the Government Printer, Pretoria.

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JOURNAL DUPLICATES.

Any readers who possess and can spare duplicates of the "Agricultural Journal" would confer a great favour by returning them to the Department of Agriculture, as back numbers are now out of print, and applications are constantly being made by persons desirous of completing their sets.

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APPLICATIONS FOR THE "JOURNAL" AND NON-DELIVERY.

Applications to be placed on the Mailing List of the "Journal," as well as complaints as to non-delivery of the "Journal," should be addressed to the Government Printer, P.O. Box 373, Pretoria, and not to the Editor of the "Journal." It is particularly requested that changes of address should also be promptly notified to the Government Printer, in order to ensure prompt delivery to addressees and to avoid unnecessary correspondence.

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All correspondence must be addressed and payments made to the Government Printer, Box 373, Pretoria.

General Notices.

LIST OF FARMERS' ASSOCIATIONS AND AGRICULTURAL SOCIETIES IN THE TRANSVAAL.

Aapjes River Ward Agricultural Society, A. F. van Gass, Pyramid Station.
Aapjes River Ward Farmers' Association, F. N. Carlisle, Pyramid Station.
Barberton Farmers' Association, Geo. E. O. Wilhelm, Box 157, Barberton.
Barberton Agricultural Society, G. S. Dyce, Box 5, Barberton.
Belfast Agricultural Society, O. J. Oosthuizen, Box 13, Belfast.
Bloemhof Agricultural Society, Izaak Hoffmann, Bloemhof.
Carolina Agricultural Society, M. van Enter, Box 43, Carolina.
Christiana Agricultural Society, A. P. Burgers, Box 27, Christiana, Secretary.
Crocodile River Farmers' Association, J. H. Schoeman, Rietfontein W., Pretoria.
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Grootspelonken Farmers' Association, J. W. Walton, Private Bag, Middagzon, Pietersburg.
Haenertsburg Farmers' Association, P. Kent, Spitzkop, Haenertsburg, *via* Pietersburg.
Heidelberg Agricultural Society, W. Harvey, Box 36, Heidelberg.
Heidelberg Burgher Land Settlements, Balfour.
Hekpoort Farmers' Association, Secretary, *via* Krugersdorp.
Hex River Farmers' Association, W. Breedt, Hex River, Rustenburg.
Highveld Farmers' Association, F. Findley, Ceylon, *via* Krugersdorp.
Highveld Farmers' Association, W. Robinson, Rustenburg.
Klerksdorp Agricultural Society, H. Bramley, Box 56, Klerksdorp.
Klip River Farmers' Association, Krugersdorp.
Koesterfontein Farmers' Association, Secretary, *via* Krugersdorp.
Krugersdorp Farmers' Association, G. Figulus, Box 188, Krugersdorp.
Krugersdorp Agricultural Society, H. A. von Blommestein, Box 368, Krugersdorp.
Lydenburg Agricultural Society, S. Hiemstra, Box 69, Lydenburg.
Lydenburg Farmers' Association, E. de Souza, Lydenburg.
Leeuwdoorns Farmers' Association, W. H. Pilkington, Baviaans Poort, *via* Leeuwdoorns.
Low Country Farmers' Association, A. W. Gale, Middelrand, P.O. Devilskloof, Zoutpansberg, N. Transvaal.
Marico Agricultural Society, S. J. van der Spuy, Box 83, Zeerust.
Maquassi Farmers' Association, E. J. Brown, P.O. Maquassi.
Middelburg Agricultural Society, J. W. Henwood, Box 229, Middelburg.
New Scotland Farmers' Association, H. S. Parry, Grasdal, Lake Chrissie.
New Agatha Farmers' Association, Henry W. Molyneux, P.O. New Agatha.
Pietersburg Agricultural Society, J. W. Johnson, Box 32, Pietersburg.
Pietersburg Farmers' Association, G. G. Munnik, Pietersburg.
Pietersburg Poultry Club, H. Moore, Box 103, Pietersburg.
Piet Retief Farmers' Association, K. P. van Dijk, Box 18, Piet Retief.
Pisanghoek Farmers' Association, W. J. Birchill, Diana, *via* Pietersburg.
Platrand Farmers' Association, A. H. Barron, Platrand.
Potchefstroom Agricultural Society, Joubert Reitz, Box 152, Potchefstroom.
Potchefstroom Burgher Land Settlements: The Manager, Box 172, Potchefstroom.
Potgietersrust Fruitgrowers' and Planters' Association, H. J. Ströbel.
Pretoria Agricultural Society, H. Cornforth, Box 685, Pretoria.
Rand Poultry Club, E. Hjort, Box 2213, Johannesburg.
Rustenburg Farmers' Association, Leo Machol, Rustenburg.
Settlers' Association, Hon. H. Wyndham, Kroomdraai.
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Southern Waterberg Farmers' Co-operative Union, T. T. Carney, Box 24, Warmbaths.
Standerton Agricultural Society, J. J. Bosman, Box 26, Standerton.
Transvaal Agricultural Union, F. T. Nicholson, Box 134, Pretoria.
Transvaal Farmers' Association, E. W. Hunt, Box 3785, Johannesburg.
Transvaal Land Owners' Association, H. A. Baily, Box 1281, Johannesburg.
Transvaal Poultry Club, M. Lochhead, Box 134, Pretoria.
Transvaal Stockbreeders' Association, F. T. Nicholson, Box 134, Pretoria.
Transvaal Tobacco Growers' Association, Capt. C. A. Madge, Secretary, Box 4303, Johannesburg.
Transvaal Con. Land Company, Capt. C. A. Madge, Box 4303, Johannesburg.
Trichardts Farmers' Association, E. v. Deventer, P.O. Trichardts, Springs.
Vaal River Farmers' Association, J. van Zijl, *via* Potchefstroom.
Waterberg Agricultural Society, J. von Backstroom, Box 7, Nylstroom.
Wakkerstroom Agricultural Society, G. Maasdorp, Box 87, Volksrust.
Witfontein Farmers' Association, J. Krugel, *via* Krugersdorp.

Witwatersrand Farmers' Association, H. J. A. Wentworth, P.O. Craighall, near Johannesburg.
Witwatersrand Dairy Farmers' Association, Alex. Sloan, Box 5908, Johannesburg.
Witwatersrand Agricultural Society, W. H. Poultney, Box 4344, Johannesburg.
White River Farmers' Association, Archibald T. Ralls, White River, *via* Nelspruit.
Wolmaransstad Farmers' Association, F. W. Konig, Box 1, Wolmaransstad.
Wolmaransstad Agricultural Society, W. D. de Greef, Wolmaransstad.
Wonderfontein Farmers' Association, Secretary, *via* Krugersdorp.
Woodbush Farmers' Association, Secretary and Treasurer, Percy Kent, Spitskop, P.O. Haenertsburg.
Zwartkop Farmers' Association, M. Vorster, Zwartkop, *via* Krugersdorp.
Zwartruggens Farmers' and Planters' Association, G. R. Wedderburn, J.P., Broadwood Vale, P.O. Kosterfontein, Rustenburg.
Zoutpansberg Agricultural Society, J. W. Johnston, Box 32, Pietersburg.

* * * *

OTHER COLONIES.

Agricultural Union of Cape Colony, D. M. Brown, Box 187, Port Elizabeth.
Bloemfontein and O.R.C. Agricultural Society, J. Fraser, Box 250, Bloemfontein.
Cape Central Farmers' Association, H. C. Hall, Bedford, Cape Colony.
Cape Stud Breeders' Association, J. Pike, Box 703, Capetown.
Natal Agricultural Union, D. M. Eadie, Timber Street, Pietermaritzburg.
Orange River Colony Central Farmers' Association, W. B. Fowler, Secretary, Hill's Buildings, Maitland Street, Bloemfontein.
Orange River Colony Stockbreeders' Association, Secretary, Bloemfontein.
Rhodesian Agricultural Union, Secretary, Box 135, Salisbury, Rhodesia.
South African Co-operative Union, A. C. Lyell, Box 574, Bloemfontein, O.R.C.
Upper Klip River Farmers' Association, Secretary, Vrede District, O.R.C.

* * * *

LIST OF OFFICIALS.

The following is a list of the officials of the Transvaal Department of Agriculture, to whom inquiries respecting matters connected with agriculture may be addressed:—

The Right Hon. the Minister of Agriculture	General Louis Botha.
Director	F. B. Smith.
Division of Veterinary Science:	
(*a*) Bacteriology	A. Theiler.
(*b*) Contagious Diseases	C. E. Gray.
Division of Chemistry	R. D. Watt (Acting).
Division of Botany	J. Burtt-Davy.
(*a*) Plant Pathology	I. B. Pole-Evans.
(*b*) Seed Introduction and Plant Experiments	H. G. Mundy.
Division of Forestry	C. E. Legat.
Division of Entomology	--
Division of Horticulture	R. A. Davis.
Division of Tobacco	J. van Leenhoff.
Division of Co-operation	B. Stilling-Andersen.
Division of Dairying	Robert Pape.
Division of Publications	William Macdonald.
Division of Poultry	Reginald Bourlay.
Government Experimental Farm, Potchefstroom	Alexander Holm.
Government Stud Farm, Standerton	A. McNae
Government Stud Sheep Farm, Ermelo	V. Bossley.
Government Experimental Farm, Tzaneen	Walter H. Charter.
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Translator	Otto Menzel.
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Librarian	J. C. Goldman.
Accountant	A. J. Firth.

* * * *

ADDRESS.

Correspondents are earnestly requested to give their full name and correct postal address when forwarding any communication to the Department. It sometimes happens that readers send their farm address only, and fail to give the Post Office address, consequently it is impossible to reply to their queries or send publications. This refers more especially to farmers applying for cattle permits, as in many cases letters forwarded by the Veterinary Division are returned by the Postal Authorities to the effect "Not delivered. Address insufficient." The Department should also be immediately notified of any change of address.

SOUTH AFRICAN STUD BOOK.

A record of all classes of stock, the object being to encourage the breeding of thoroughbred stock and to maintain the purity of breeds, thus enhancing their value to the individual owner and to the country generally.

Application for membership and entries of stock should be addressed to—

For Cape Colony—J. Pike, P.O. Box 703, Capetown.
For Transvaal—F. T. Nicholson, P.O. Box 134, Pretoria.
For Orange River Colony—E. J. MacMillan, Government Buildings, Bloemfontein.

The South African Stud Book, Volume I., is obtainable from T. Maskew Miller, Adderley Street, Capetown. Price, 10s. 6d.

J. PIKE, *Secretary*,
South African Stud Book Association.

DEPARTMENT OF IRRIGATION.

ADVICE TO FARMERS.

It is hereby notified for general information that the Irrigation Department is prepared to give advice to farmers on any farm relative to irrigation problems, in accordance with regulations approved by the Hon. the Minister for Lands.

Farmers are expected to facilitate the transport of the Irrigation Officials from farm to farm wherever possible.

Application should be made by letter to the Chief Engineer, Irrigation Department, Pretoria, or to the Resident Magistrate of the District.

F. A. HURLEY,
Chief Engineer, Irrigation.

* * * *

PROCLAMATION

BY HIS EXCELLENCY THE HONOURABLE SIR WALTER FRANCIS HELY-HUTCHINSON,

Knight Grand Cross of the Most Distinguished Order of Saint Michael and Saint George, Governor and Commander-in-Chief of His Majesty's Colony of the Cape of Good Hope, and of the Territories and Dependencies thereof, etc., etc., etc.

UNDER and by virtue of the powers and authorities in me vested by the provisions of Section 4 of Act No. 16 of 1906, intituled "The Animal Diseases Act Amendment Act, 1906," I do hereby proclaim, declare and make known that, whereas the disease known as East African Coast Fever exists among cattle in the Transvaal, it shall not be lawful from and after the date of promulgation hereof, and until this Proclamation be otherwise amended or repealed to introduce or cause or allow Cattle Manure to be introduced from the Transvaal into this Colony:

And I do further declare that any person who shall introduce or cause or allow Cattle Manure to be introduced into this Colony from the Transvaal in contravention of this Proclamation shall, upon conviction, be liable to a fine not exceeding twenty-five pounds sterling, or, in default of payment, to imprisonment with or without hard labour for a period not exceeding three months, unless such fine be sooner paid.

GOD SAVE THE KING.

Given under my Hand and the Public Seal of the Colony of the Cape of Good Hope, this 10th day of August, 1908.

WALTER HELY-HUTCHINSON,
Governor.

By Command of His Excellency the Governor in Council.

F. S. MALAN.

No. 329, 1908.

Transvaal Meteorological Department.

Observations of Temperatures (from Self-registering Thermometers in Stevenson-type Screens).—May, 1908.

Place.	For the Month. Mean Max.	Mean Min.	Mean.	Highest.	Lowest.
	degs.	degs.	degs.	degs.	degs.
Bloemhof	73·5	37·3	55·4	80·0 on the 4th and 6th	28·0 on 30th
Johannesburg—					
Joubert Park ...	66·4	41·8	54·1	72·5 on 16th	32·7 „ 29th
Observatory ...	65·2	46·5	55·8	70·3 „ 16th	36·5 „ 24th
Pretoria, Arcadia ...	74·1	39·9	57·0	80·1 „ 3rd	31·1 „ 29th
Standerton	69·4	32·7	51·0	77·0 „ 15th	22·0 „ 30th
Volksrust	64·3	35·0	49·6	73·3 „ 17th	27·5 „ 22nd
Zeerust	75·2	37·5	56·4	83·6 „ 4th	29·0 „ 28th

May, 1908, has been a bright and sunny month with but little wind. Temperatures have been higher, both by day and by night, than in 1907.

Rainfall Return for May, 1908.

(Including Rainfall since 1st July last and corresponding averages for previous season.)

Note.—The rainy season is measured from 1st July in one year to the 30th June in the next.

District.	Place.	Month. May, 1908. Ins.	Days.	Season. From 1st July, 1907. Ins.	Days.	Averages. Month. Ins.	Days.	Averages. Season. Ins.	Days.
Barberton ...	Barberton	0·08	2	17·83	75	0·04	1	26·72	74
	Komatipoort	0·14	1	19·31	50	0·38	1	25·52	65
Bethal ...	Bethal	0·04	1	27·03	87	0·30	5	26·46	85
Bloemhof ...	Bloemhof	nil	0	16·26	72	0·64	5	20·20	72
Carolina ...	Carolina	0·05	1	23·99	68	—	—	—	—
Ermelo ...	Ermelo	0·02	1	26·11	84	0·10	2	-	—
Heidelberg ...	Heidelberg	0·01	1	22·77	82	0·24	3	28·05	79
	Vereeniging	nil	0	22·60	76	0·36	4	25·06	86
Lichtenburg	Lichtenburg	nil	0	--	—	0·22	3	20·98	78
Lydenburg ...	Belfast	0·46	3	26·70	83	0·10	3	30·65	111
	Pilgrims Rest	0·31	6	25·99	116	0·39	8	36·35	134
Marico ...	Zeerust	nil	0	18·77	58	0·24	2	22·64	80
Middelburg ...	Middelburg	nil	0	23·40	83	0·28	3	26·15	88
Potchefstroom	Potchefstroom	0·02	1	22·05	73	0·39	3	23·64	76
	Klerksdorp	nil	0	17·32	80	0·40	3	24·12	88
Pretoria ...	Arcadia, Pretoria ...	nil	0	19·92	83	0·30	2	26·04	85
	Govt. Buildings, Pretoria	nil	0	17·41	71	0·30	2	23·18	74
	Modderfontein	nil	0	22·08	80	0·53	3	26·53	91
Rustenburg ...	Rustenburg	nil	0	--	—	0·28	1	—	—
Standerton ...	Standerton	0·05	1	31·24	96	0·37	4	—	—
Swaziland ...	Mbabane	0·02	1	41·54	118	0·51	4	43·79	122
Wakkerstroom	Volksrust	0·13	2	28·03	98	0·41	2	31·87	91
	Wakkerstroom	0·34	1	30·60	69	—	—	—	—
Waterberg ...	Nylstroom	nil	0	18·97	63	0·20	1	23·38	70
	Potgietersrust	nil	0	18·77	60	0·01	1	26·08	66
Witwatersrand	Krugersdorp	nil	0	22·05	84	—	—	—	—
	Joubert Park, J'burg ...	nil	0	27·48	91	0·22	2	31·43	92
	Govt. Observatory, J'burg	nil	0	23·49	85	0·21	2	27·76	91
Wolmaransstad	Wolmaransstad	nil	0	18·25	65	0·85	3	21·27	68
Zoutpansberg	Pietersburg	nil	0	15·68	57	0·03	1	20·82	60

Summary.—Some places in the E. and S.E. of the Transvaal had small but average rainfalls during May; elsewhere the rainfall was "nil." Heavy dews and mists have, however, provided some moisture. In all parts the rainfall is below the average and there is a general lowness of water in rivers and springs.

OBSERVATIONS OF TEMPERATURES (FROM SELF-REGISTERING THERMOMETERS IN STEVENSON SCREENS).—JUNE, 1908.

PLACE.	For the Month. Mean Max.	Mean Min.	Mean.	HIGHEST.	LOWEST.
	degs.	degs.	degs.	degs.	degs.
Bloemhof	67·7	31·8	49·8	74·2 on 2nd	22·0 on 5th
Johannesburg—					
Marist Bros. College	65·2	40·7	53·0	70·0 „ 1st, 2nd, 3rd	34·0 „ 5th & 28th
Observatory ...	62·6	44·9	53·8	68·2 „ 3rd	34·1 „ 6th
Komatipoort	82·3	51·6	67·0	94·0 „ 16th	38·0 „ 1st
Pietersburg	71·5	40·1	55·8	79·0 „ 14th	35·0 „ 4th
Pretoria, Arcadia ...	71·1	38·8	55·0	74·3 „ 15th	32·6 „ 28th
Standerton	67·5	31·7	49·6	73·0 „ 21st	19·0 „ 5th & 28th
Zeerust	71·6	35·9	53·8	77·8 „ 2nd	28·0 „ 6th

June, 1908, has been a bright and rather mild month. The mean temperature of the month has been generally about 2 degrees higher than that of June, 1907. Frosts have frequently occurred over the high veld, but they have been of a light character.

RAINFALL RETURN FOR JUNE, 1908.

(Including Rainfall since 1st July last and the corresponding averages for previous season.)

NOTE.—The rainy season is measured from 1st July in one year to the 30th June in the next.

DISTRICT.	PLACE.	MONTH. June, 1908. Ins.	Days.	SEASON. From 1st July, 1907. Ins.	Days.	AVERAGES. Month. Ins.	Days.	Season. Ins.	Days.
Barberton ...	Komatipoort	0·47	4	19·78	54	0·10	1	25·62	65
Bethal ...	Bethal	0·06	1	27·09	88	0·00	0	26·46	85
Bloemhof ...	Bloemhof	0·14	2	16·40	74	0·01	1	20·21	72
Carolina ...	Carolina	0·12	3	24·11	71	0·00	0	27·77	--
Ermelo ...	Ermelo	0·14	2	26·25	86	0·00	0	32·81	89
Heidelberg ...	Vereeniging	0·00	0	22·60	76	0·00	0	25·06	86
	Heidelberg	0·00	0	22·77	82	0·00	0	28·05	79
Lichtenburg...	Lichtenburg	0·00	0	18·69	35	0·00	0	20·98	78
Lydenburg ...	Belfast	0·06	3	26·76	86	0·00	0	30·65	111
	Pilgrims Rest	0·34	8	26·33	124	0·06	2	33·08	136
Marico ...	Zeerust	0·00	0	18·77	57	0·00	0	22·64	80
Middelburg ...	Middelburg	0·00	0	23·40	83	0·00	0	26·15	88
Piet Retief ...	Piet Retief	0·61	5	30·06	—	—	—	—	—
Potchefstroom	Potchefstroom	0·03	1	22·08	74	0·01	1	23·64	76
	Klerksdorp	0·03	1	17·35	81	0·01	1	24·14	89
Pretoria ...	Arcadia, Pretoria ...	0·00	0	19·92	83	0·00	0	26·04	85
	Govt. Buildings, Pretoria	0·0[illegible]	0	17·41	71	0·00	0	23·18	74
	Modderfontein	0·00	0	22·08	80	0·00	0	26·53	91
Rustenburg ...	Rustenburg	0·00	0	--	—	—	—	—	—
Standerton ...	Standerton	0·17	2	31·41	98	0·01	1	—	—
Swaziland ...	Mbabane	0·71	5	42·25	123	0·06	1	43·85	123
Wakkerstroom	Volksrust	1·06	2	29·09	100	0·00	0	31·87	91
Waterberg ...	Potgietersrust	0·00	0	18·77	60	0·03	1	—	—
	Nylstroom	0·00	0	18·97	63	0·00	0	23·38	70
Witwatersrand	Joubert Park, J'burg ...	0·02	1	27·50	92	0·00	0	31·00	92
	Govt. Observatory, J'burg	0·00	0	23·49	85	0·00	0	27·76	91
	Krugersdorp	0·00	0	22·05	84	—	—	—	—
Wolmaransstad	Wolmaransstad	0·04	2	18·29	67	0·00	0	21·27	68
Zoutpansberg	Pietersburg	0·00	0	15·68	57	0·00	0	20·82	60
	Leydsdorp	0·09	2	17·01	39	—	—	—	—

SUMMARY.—Some useful rainfalls occurred over the E. and S.E. of the Transvaal. There were also light thunder-showers over the S.W., but no rain fell over the centre and west. The atmosphere was very moist during the month, and heavy dews and damp mists were of frequent occurrence.

The rainfall for the whole season is decidedly below the average.

Observations of Temperatures (from Self-registering Thermometers in Stevenson Screens).—July, 1908.

Place.	For the Month. Mean Max.	Mean Min.	Mean.	Highest.	Lowest.
	degs.	degs.	degs.	degs.	degs.
Bloemhof	65·6	32·8	49·2	76·5 on 31st	16·0 on 7th
Johannesburg—					
Joubert Park ...	57·9	37·6	47·8	67·5 „ 29th & 30th	26·5 „ 7th
Observatory ...	58·4	41·0	49·7	68·0 „ 30th	31·8 „ 31st
Komatipoort	79·0	47·8	63·4	91·0 „ 17th	32·0 „ 23rd
Pretoria, Arcadia ...	66·9	35·7	51·3	74·6 „ 30th	29·1 „ 7th
Volksrust	59·3	31·4	45·4	69·3 „ 31st	21·0 „ 26th
Zeerust	66·0	35·3	50·6	73·0 „ 30th	24·5 „ 7th

The month has been generally mild with no very marked extremes of temperature. The cloudiness of the sky has been much greater than is usual in July.

Rainfall Return for July, 1908.

District.	Place.	July, 1908. Ins.	Days.	Average for July. Ins.	Days.
Barberton	Barberton	0·05	3	0·01	1
	Komatipoort	0·01	1	0·06	1
Bethal	Bethal	0·49	3	0·00	1
Bloemhof	Bloemhof	1·42	5	0·29	1
Carolina	Carolina	0·05	1	1·01	1
Ermelo	Ermelo	0·24	3	0·05	1
	De Hoop...	0·22	4	0·07	1
Heidelberg	Heidelberg	0·53	5	0·11	1
	Vereeniging	0·54	7	0·09	1
Lichtenburg... ...	Lichtenburg	1·54	6	0·31	1
Lydenburg ...	Belfast	0·00	0	0·01	1
	Pilgrims Rest	0·67	5	0·27	4
Marico	Zeerust	1·17	4	0·23	1
Middelburg	Middelburg	0·07	1	0·01	1
Potchefstroom ...	Potchefstroom	0·69	4	0·14	1
	Klerksdorp	0·86	4	0·18	1
Pretoria	Arcadia, Pretoria	0·45	2	0·09	1
	Govt. Buildings, Pretoria ...	0·34	2	0·06	1
	Modderfontein	0·56	3	0·09	1
Rustenburg	Rustenburg	1·25	3	—	—
Standerton	Standerton	0·44	4	0·09	1
Swaziland	Mbabane...	1·28	6	0·40	3
Wakkerstroom ...	Volksrust	0·24	5	0·09	2
Waterberg	Nylstroom	0·07	2	0·01	1
	Potgietersrust	0·27	2	0·05	1
Witwatersrand ...	Krugersdorp	0·70	3	0·12	1
	Joubert Park, J'burg	1·03	5	0·17	1
	Govt. Observatory, J'burg ...	0·84	3	0·17	1
Wolmaransstad ...	Wolmaransstad	0·91	4	0·18	1
Zoutpansberg ...	Pietersburg	0·38	3	0·08	1
	Leydsdorp	0·04	1	—	—

Summary.—July, 1908, has been remarkable for the rainy period extending from the 12th to the 19th of the month. Rain fell over almost the whole of the Colony, the heaviest falls taking place in the west and south-west. The rainfall at Joubert Park is the greatest July rainfall since 1888.

Pretoria and Johannesburg Produce Market Prices.

(Supplied by the Commercial Agency Co., Limited, Seed and Produce Merchants No. 116 Vermeulen Street, Telephone No. 165, Box 784, Pretoria: and by Messrs. Hubert Morisse & Co., Produce Merchants and Commission Agents, Loveday and Frederick Streets, Box 63, Johannesburg.)

PRETORIA.

Description.	*June*, 1908.		*July*, 1908.		*August*, 1908.	
	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Bran, per bag	0 8 9	0 9 6	0 8 6	0 9 3	0 7 6	0 10 0
Barley, per bag	—	—	—	—	0 11 6	
Butter, per lb.	0 1 0	0 2 0	0 1 0	—	0 1 7	
Beans, dry, per bag ...	0 17 0	1 5 0	0 17 0	0 17 9	—	
Ducks, each	0 1 9	0 3 0	0 2 6	0 3 6	0 2 3	0 3 1
Eggs, per doz.	0 1 5	0 2 1	—	—	—	—
" (fresh) ...	0 2 0	0 2 6	0 1 5	0 2 0	0 1 3	0 2 0
Forage, 100 bundles ...	0 12 6	1 1 0	0 10 0	1 5 6	0 9 3	0 16 0
" (100 lbs.)	0 5 6	0 6 6	0 4 3	0 6 0	—	—
Fowls, each	0 1 5	0 2 1	0 1 3	0 2 0	0 1 6	0 2 3
Fruit (dried), per lb. ...	0 0 6	0 0 9	—	—	—	—
Geese, each...	—	—	0 7 3	—	—	—
Hay, per bale	0 0 4	0 1 0	0 0 3	0 0 11	0 0 4½	0 0 8
Kaffir Corn, per bag ...	0 10 0	0 14 0	0 10 3	0 11 0	0 13 3	—
Green Lucerne, per doz. bundles	0 1 3	0 1 9	0 1 3	0 2 3	0 1 0	0 1 9
Manna, per 100 bundles ...	0 4 0	0 5 6	0 4 6	0 7 9	0 4 9	0 8 6
" per bale	—	—	0 1 7	—	—	—
White Mealies, per bag ...	0 8 0	0 9 0	0 8 3	0 9 6	0 9 6	0 10 6
Yellow Mealies " ...	0 8 6	0 10 0	0 9 0	0 10 0	0 10 3	0 11 0
Onions, per bag	0 18 6	1 3 0	—	—	1 1 0	—
Pigs, each	0 15 0	3 0 0	0 14 6	3 2 0	2 4 0	—
Pigeons, each	0 1 0	—	—	—	0 0 7	—
Pumpkins, each	0 0 3	0 1 0	0 0 7	—	0 0 5	—
Potatoes, per bag	0 10 0	0 19 0	0 14 3	1 1 6	0 14 0	1 1 6
" (sweet), per bag ...	0 4 6	0 7 6	0 3 6	0 7 6	0 6 9	0 8 3
Oats (seed), per bag ...	0 11 6	1 0 0	0 8 9	0 9 0	0 9 0	—
Boer Meal, per bag ...	1 6 0	1 11 0	0 15 0	1 7 0	—	—
Turkeys, each	0 5 6	0 7 9	0 4 3	0 7 6	0 6 0	0 7 6
Muscovies, each	0 2 0	0 3 3	0 2 0	0 2 6	0 2 6	—
Tobacco, per roll	0 0 3	0 0 6	0 0 3	0 0 6	0 0 3	0 0 9
" cut, per lb. ...	—	—	0 0 6	—	—	—
Wheat, per bag	1 1 0	1 4 6	0 19 9	1 3 6	—	—
Firewood, per load ...	0 14 0	2 10 0	0 11 0	2 17 6	0 14 0	2 7 6
Chaff, per bale	0 0 10	—	0 0 10	—	—	—
" (pressed) ...	—	—	—	—	0 0 9	0 1 4
Monkey Nuts, per bag ...	0 9 0	—	0 7 9	0 8 9	0 7 3	—
Rye, per bag	0 17 6	—	0 17 0	—	—	—
Potatoes, (seed) per bag ...	0 9 6	—	0 9 6	—	—	—
Fowls, Guinea	0 2 8	—	0 2 5	0 2 8	0 2 3	—

JOHANNESBURG.

Description.	*June*, 1908.						*July*, 1908.						*August*, 1908.					
	Lowest.			Highest.			Lowest.			Highest.			Lowest.			Highest.		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
Barley, per 163 lbs. ...	0	6	9	0	8	6	0	7	0	0	10	6	0	7	3	0	9	3
Bran, per 100 lbs. (Colonial)	0	8	3	0	8	9	0	8	0	0	8	6	0	7	3	0	8	6
Chaff, best, per 100 lbs. ...	0	2	6	0	3	6	0	2	6	0	3	3	0	2	9	0	3	9
„ medium „ ...	0	1	0	0	2	3	0	1	3	0	2	3	0	1	0	0	2	6
Eggs, per doz. (Colonial) ...	0	1	0	0	2	0	0	1	2	0	1	7	0	1	0	0	1	7
Salt, per bag	0	6	0	0	6	3	0	4	9	0	6	3	0	4	0	0	6	3
Forage (Transvaal) ...	0	4	6	0	5	9	0	4	9	0	6	3	0	4	6	0	5	9
„ (Colonial) best, 100lbs	0	5	9	0	6	3	0	6	0	0	6	3	0	5	9	0	6	6
„ „ med. „	0	3	0	0	4	9	0	3	9	0	5	0	0	3	0	0	5	3
S. Meal, best fine	1	6	0	1	8	0	1	5	0	1	8	6	1	6	0	1	8	6
Rye	0	9	6	0	11	9	0	10	6	0	14	6	0	11	0	0	13	9
Wheat	0	19	0	1	2	0	0	19	0	1	1	6	0	19	0	1	1	6
Mealies, Hickory King Whites	0	8	3	0	8	9	0	8	6	0	9	6	0	8	6	0	9	10
„ (O.R.C.), Whites ...	0	8	3	0	8	6	0	8	6	0	9	4	0	8	6	0	9	6
„ Yellow	0	8	6	0	9	9	0	8	9	0	10	3	0	8	6	0	11	3
Kaffir Corn	0	8	3	0	10	9	0	9	0	0	12	3	0	9	0	0	13	9
Hay, sweet (Transvaal) ...	0	1	0	0	1	6	0	1	6	0	2	1	0	1	6	0	2	1
Lucerne, per 100 lbs. ...	0	6	0	0	7	9	0	6	6	0	7	9	0	6	6	0	8	3
Manna	0	2	6	0	3	9	0	2	9	0	4	3	0	2	9	0	3	9
Transvaal Hay	0	0	7	0	1	0	0	0	7	0	1	0	0	0	7	0	1	5
Oats, per 153 lbs.	0	7	0	0	9	9	0	7	6	0	10	9	0	7	3	0	9	6
Potatoes, best, per 153 lbs.	0	10	0	0	15	9	0	13	0	0	15	0	0	12	6	0	19	6
„ med.	0	7	9	0	13	6	0	11	0	0	14	6	0	10	0	0	17	6
„ inferior „ ...	0	6	0	0	11	0	0	6	0	0	11	6	0	8	3	0	15	0
Onions, per 120 lbs. (Colonial)	0	15	6	0	18	6	0	16	6	1	3	0	0	15	6	1	4	0
Turkeys, cocks	0	5	0	0	12	0	0	5	0	0	12	0	0	6	0	0	12	6
„ hens	0	2	6	0	5	0	0	2	0	0	5	0	0	2	6	0	6	0
Fowls	0	1	0	0	2	9	0	1	0	0	3	0	0	1	0	0	4	0
Ducks	0	1	6	0	2	9	0	1	6	0	2	9	0	1	6	0	4	4
Geese	0	4	3	0	4	9	0	3	6	0	4	9	0	4	6	0	6	0
Pigeons	0	0	6	0	0	10	0	0	6	0	0	10	0	0	6	0	0	9
Butter (O.R.C.), per lb. ...	0	1	0	0	1	4	0	1	0	0	1	5½	0	1	0	0	1	5
Pumpkins, each	0	0	1	0	0	3	0	0	1	0	0	3	0	0	1	0	0	8
Beans, per 200 lbs. (sound)	0	16	6	2	6	6	0	16	6	2	6	0	0	16	0	2	6	0

The Downy Mildew of the Grape Vine.

(*Plasmopara viticola*, Berl. & De Toni.)

Under surface of leaf showing the fungus

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The Immunity of Mules Against Horse-Sickness.

By Dr. Arnold Theiler, C.M.G., Government Veterinary Bacteriologist.

The inoculation of mules against horse-sickness was introduced into practice in November, 1905, in the various districts of the Transvaal, as well as in Swaziland and Rhodesia. A year later it was also adopted in the Orange River Colony, Natal, and Bechuanaland Protectorate; and, from November, 1905, to June, 1908, some 12,000 mules have been treated in South Africa.

Within the last three seasons, horse-sickness has been present in varying degrees of severity. It was fairly severe in 1905-06; the following season was an extremely bad one, but it was only mild in 1907-08. Naturally, the greatest number of immunised mules were exposed last year, but the season being mild, we are not entitled to attach any great importance to the results, although the experience gained proved very interesting. The two years, 1905-07, during which time 8,325 immunised mules were exposed, offered a very severe test to the inoculation, and it is during these two years especially that we have been able to increase our knowledge concerning the immunity against horse-sickness in general, and of mules in particular.

The farmer considers an animal immune or "salted" against horse-sickness when that animal has had an attack of the disease, either the dik-kop or the dun-kop form. He is inclined to believe that an animal which has recovered from an attack of dun-kop is not so well salted as the animal that recovered from dik-kop, and, generally speaking, thinks that an animal which has recovered from dik-kop is completely salted. If he was given the opportunity his choice would undoubtedly be for the animal that had recovered from dik-kop. The term "salted" is not only applied to animals that have recovered from horse-sickness, but also to those which, for some years, have been living in a notoriously bad district, and, although they were probably not noticed to contract the disease, the mere fact that the companions of such animals succumbed is considered to be sufficient proof that the surviving animals are salted. In this paper we shall apply the term "salted" to animals that have either actually recovered from an attack of the disease or else have resisted an otherwise fatal dose of horse-sickness virus.

Horse-sickness can be produced by the inoculation of blood taken from an animal suffering from either the dun-kop or the dik-kop form. At the time of inoculation it is impossible to say which form of the disease an animal will contract, but the fact is noteworthy that amongst animals inoculated with serum and virus, there is a greater percentage of animals showing the symptoms of dun-kop than of those showing the dik-kop form. Our experimental statistics show that, for the years 1904-08, of 635 animals inoculated on the station, 103, or 16 per cent., showed the symptoms of dik-kop; the other 532, or 84 per cent., developed dun-kop, that is to say a fever reaction showing no visible symptoms, except in rare cases when an accelerated respiration is present.

Generally speaking, from our point of view, the appearance of dik-kop is not a desirable occurrence. Experience has shown that the majority of animals contracting dik-kop before the thirteenth day do not survive, but they usually recover if they show signs of dik-kop after that period. The post-mortem examination of animals that die from dik-kop on this date or later, and particularly those that had symptoms of dik-kop and died after the thirteenth day, show extensive heart-lesions. It stands to reason, therefore, that in animals showing dik-kop after this date and recovering, these lesions must cause a defective heart to some extent, and such animals may reasonably be expected to no longer be the same spirited and fast animals as they were before the inoculation. There is, however, not any, or but little change in the pulmonary (dun-kop) form of horse-sickness, and a complete recovery is possible. This is apparent by the fact that after mules have recovered from mere fever reactions it is only in exceptional cases that any of them show a change in temperament or lose their swiftness.

It appears to us that since exactly the same virus and serum is used on a particular batch of animals, the appearance of dik-kop in only a certain percentage must be connected with the individuality of these animals. The same argument holds good with the 3 per cent. or 4 per cent. of animals which die during immunisation. Undoubtedly some factor enters into consideration which we do not seem to understand, and, therefore, are unable to control.

When the inoculation was introduced into practice, all enquirers were informed that we considered the immunity given by the inoculation to be equal to and as good as that obtained from a natural attack of horse-sickness. We based this opinion on the fact that no difference was observed in the pathological lesions of mules contracting horse-sickness in the natural way, and by inoculation of virus. Naturally, under the influence of the serum the symptoms of the disease were of a milder character than those of animals contracting the disease spontaneously and recovering.

A further proof for our assertion was the fact that we were unable to break the immunity of any of our animals notwithstanding the injections of virus under the skin or into the jugular vein, and we only need refer to our method of preparing serum to show what enormous quantities of virus an immune animal can resist without the least breakdown in immunity. Our serum is obtained by hyperimmunising the animals, that is to say by transfusing about 1½ gallons of virulent blood from a sick to a salted animal. One drop of horse-sickness

blood is capable of producing the disease in the majority of susceptible animals, and we have rarely met an animal capable of resisting twenty drops of the virus which we use in practice. In other words, an immune mule resists between 9,000 and 180,000 times the quantity necessary to produce the disease in a susceptible animal. Our statistics on this point show that up to January, 1907, altogether, 295 mules were experimentally tested in this way. Amongst these were 41 mules which received 3 gallons, 13 mules received 4½ gallons, 1 was infused with 6 gallons, and 2 with 7½ gallons, and, in no instance, was any breakdown of immunity observed. We, therefore, had reason to believe that once an animal was immunised it would resist enormous quantities of virus, and naturally considered that the same principle would hold in practice.

It must be stated here that these tests were always made with the same virus, that is, the virus with which the mules were inoculated; it was obtained from a horse suffering from horse-sickness contracted naturally in Pretoria, and, in distinction to any other virus, is called "ordinary."

SEASON 1905-06.

As already stated, the inoculation was introduced into the Transvaal and Rhodesia in 1905, and, by June, 1906, 3,235 mules had been treated. Of this number, 21 were reported to have died of horse-sickness after discharge, and 45 as having shown symptoms of horse-sickness, described as relapses or "aanmaanings."

Under these reports of relapses or aanmaanings we do not include animals which died between the 21st and 28th days after inoculation, but only those dying subsequently to the 28th day. Generally speaking, twenty-one days from the date of the inoculation is sufficient for an animal to recover from horse-sickness, but, in quite exceptional cases, latent infections have been noted, where the incubation time is longer than twenty days, so that the animal dies of horse-sickness within four weeks. It is practically impossible to state whether an animal which dies from four to five weeks after inoculation is suffering from a relapse or a prolonged incubation due to the inoculation of the virus.

Whether all the 21 animals mentioned died from horse-sickness we are not in the position to say, but we can confidently state that not more than 21 animals died after discharge from horse-sickness out of the 3,119 exposed.

Thus, for the season 1905-06 the percentage of relapses was 1·4 per cent., and the mortality was only 0·6 per cent.

Hitherto I have not mentioned the experience of the farmers in regard to breakdowns in immunity. They refer to them as relapses or aanmaanings, and their opinions on this point differ somewhat. Many affirm that an animal immune to either form of horse-sickness is salted for its life-time; others believe that animals immune against horse-sickness will show a relapse every year, or, anyway, from time to time; whilst others again consider as salted animals only those that have recovered from the dik-kop form. The general opinion is that an animal suffering from aanmaaning will not die, provided it is not worked during that time and is well cared for.

The breakdowns which occurred in practice during the season under review, and which were entirely unexpected, rendered it necessary for us to investigate the matter and endeavour to elucidate the cause. I have mentioned that at the Laboratory we were unable to break the immunity of inoculated animals notwithstanding the injection of large quantities of the same virus and the repetition of these injections at intervals. At first sight we were under the impression that one or the other animals immunised in practice might not have received the virus, but this opinion was untenable. It was then thought that, under the influence of the serum, some animals might not react at all, but, in view of our experience at the Laboratory where, up to date, over 1,000 mules have been tested, this opinion had also to be abandoned, and nothing remained but to accept the fact that, although our animals were immune against horse-sickness, yet, in practice, one or the other will show relapses.

By June, 1906, relapses were reported from Barberton, Lydenburg, Piet Retief, Rustenburg, Zoutpansberg, Waterberg, and Rhodesia. Two particular cases were investigated, one which occurred in Tzaneen, and another in Bulawayo. The former was a horse that had been immunised and tested against horse-sickness, and, subsequently, was exposed in that locality; it contracted horse-sickness and died on the 7th April, 1906, and the virus (referred to as "Tzaneen") was forwarded to the Laboratory. The other was a mule in Bulawayo that had been immunised in the ordinary way, but showed a relapse to horse-sickness after discharge on the 9th April, 1906, during which time it was tapped and the virus (called "Bulawayo") was sent to Pretoria.

In order to settle the point whether an animal that had been immunised on this station would contract horse-sickness when subjected to either of the two vira, the following experiments were made:—

"*A.*" 139 mules immune against ordinary virus were subsequently tested with Tzaneen virus; the result was that 12 showed reactions; 4 reactions with lesions of dik-kop; and 1 gave a reaction and died.

"*B.*" 36 mules immune against the ordinary virus were subsequently tested with Bulawayo virus, the result being that 8 showed reactions; 6 reactions with dik-kop; and 6 gave reactions and died.

Thus it was established in an unmistakable way that we were able to produce horse-sickness in animals which undoubtedly were immune, by the injection of virus of a different nature to that with which they were previously immunised.

Among these tests which were carried out were mules which, previously to the injection of Tzaneen or Bulawayo virus, had been hyperimmunised three and four times with ordinary virus.

The cases of the following mules afford interesting examples of this phenomena:—

(*a*) 1 mule, No. 1044, immune against ordinary virus, was hyperimmunised with 6 gallons of ordinary virus; tested later by the injection of 10 c.c. (200 drops) of Tzaneen virus and showed a reaction.

(*b*) 1 mule, No. 1043, immune against ordinary virus, was hyperimmunised with 1½ gallons of ordinary virus; tested later with 5 c.c. Tzaneen virus and showed a reaction; retested with 5 c.c. Bulawayo virus and showed a reaction.

(*c*) 4 mules, Nos. 849, 889, 1018, and 1040, immune against ordinary virus, were hyperimmunised with 3 gallons each of the same virus; tested later by the injection of 5 c.c. Tzaneen virus, and 1 showed a reaction; retested with 5 c.c. Bulawayo virus, and 3 showed reactions, accompanied with dik-kop, and 1 gave a reaction and died of horse-sickness.

SEASON 1906-07.

From these experiments, in the first instance, we concluded that virus Tzaneen and Bulawayo were stronger than the virus ordinary with which the mules had been immunised, and we naturally considered that, for practical purposes, it would be more advisable to immunise in future with a virus which breaks the immunity obtained from the ordinary virus. Accordingly, at the commencement of the season 1906-07, we introduced the Tzaneen virus into practice, concluding that as it was a low-veld virus, it would be eminently suitable for the conditions of the Transvaal.

Subsequent to the introduction of the Tzaneen virus into practice in September, 1906, experiments were conducted on the station for the purpose of testing the immunity in the reverse order, and to see whether animals immune against Tzaneen virus would be immune when tested with ordinary and Bulawayo virus, and also if animals immune against Bulawayo virus would be protected against ordinary and Tzaneen virus.

The following statistics compiled from the complete experiments give the necessary information on these points:—

(*a*) 59 mules, immune against Tzaneen virus were tested later with ordinary virus; the result was that 47 showed reactions; 2 reactions, accompanied with the symptoms of dik-kop; and 5 gave reactions and died of horse-sickness.

(*b*) 13 mules, immune against Tzaneen virus, were tested later with Bulawayo virus, the result being that 8 showed reactions, and 1 gave a reaction and died of horse-sickness.

(*c*) 3 mules, immune against Bulawayo virus, were tested later with ordinary virus and all showed reactions.

(*d*) 5 mules, immune against Bulawayo virus, were tested later with Tzaneen virus, and three gave reactions.

Our experiments not only demonstrate the fact that the immunity obtained from one virus does not completely protect against either of the other two, but that animals immune against two of the three vira may break down when subjected to the third virus. The following serves as an example; two mules immune against a mixture of Tzaneen and Bulawayo virus were tested at a later date with ordinary virus and both showed reactions.

From this it is evident that we cannot exactly speak of a virus being stronger than another one, but that each virus produces a different immunity.

The particulars of breakdowns given previously enable us to arrange the virus in the following order:—

	Reactions.	Reactions and Dik-kop.	Reactions and Death.
Immunity against ordinary virus is broken by Tzaneen virus to the extent of	9%	3%	0·7%
Immunity against Tzaneen virus is broken by Bulawayo virus to the extent of	61%	Nil	8%
Immunity against Tzaneen virus is broken by ordinary virus to the extent of	80%	2%	8%
Immunity against ordinary virus is broken by Bulawayo virus to the extent of	22%	17%	17%
Immunity against Bulawayo virus is broken by Tzaneen virus to the extent of	60%	--	-
Immunity against Bulawayo virus is broken by ordinary virus to the extent of	100%		-
Immunity against Tzaneen and Bulawayo virus is broken by ordinary virus to the extent of	100%	--	-

The above statistics are compiled from the relapses amongst mules tested at the Laboratory, and these tests were undoubtedly severe. They prove that immunity in a mule from either virus can be broken down, but they do not give an accurate picture of what really happens in practice.

As already stated, we were under the impression that the Tzaneen virus would be stronger than the ordinary virus, and, therefore, the immunity would be better, and, by the beginning of 1907, over 1,200 mules were inoculated with that particular virus. The breakdowns of mules were reported as under:—

Pietersburg inoculated 193 mules, and 7 were reported to have died, after discharge from horse-sickness	=1%
Waterberg inoculated 162 mules and 1 was reported to have died, after discharge, from horse-sickness	= 0·6%
Middelburg inoculated 78 mules, and 3 were reported to have died, after discharge, from horse-sickness	=-1%
Barberton inoculated 31 mules, and 1 was reported to have died, after discharge, from horse-sickness	=-3%
Pretoria inoculated 375 mules and 1 was reported to have died, after discharge, from horse-sickness	=-0·3%

In other words, immunity against Tzaneen virus protects against natural infection in practice to the extent of about 98·5 per cent.

Comparing these results with the experimental tests, we notice the enormous difference between a practical and an experimental test; the difference in immunity between ordinary virus as experienced in 1905-06 and that of 1906-07, is but very slight, so that, for all practical purposes, the immunity obtained from the Tzaneen virus (98·5 per cent.) is only slightly less than that given by the ordinary virus (99·4 per cent.)

Season 1907-08.

As far as it was possible, blood of breakdowns occurring in 1905-07 was collected by the District Veterinary Surgeons and forwarded to the Laboratory for the purpose of further investigations.

Seeing that one particular kind of virus alone was not able to completely protect against subsequent inoculations of a second or third virus. we proceeded to make what is called a "polyvalent virus," namely, a virus composed of blood collected from mules showing

relapses in practice, together with the ordinary virus already used in practice, the virus Tzaneen introduced in September, 1906, and the virus Bulawayo, which has not yet been used for practical purposes, and, in addition, all the blood collected from spontaneous cases of horse-sickness, chiefly in the Zoutpansberg District.

These were all mixed together, and a horse was injected, which developed horse-sickness; it was tapped during the reaction, and this virus was called polyvalent. A number of experiments were now made to test the value of the immunity of an animal inoculated with the polyvalent virus.

Altogether 100 mules were immunised against this polyvalent virus, and were subsequently tested. The following statistics show the results of the tests:—

	Reactions.	Reactions with Dik-kop.	Reactions and Death.
Immunity against polyvalent virus is broken by ordinary virus to the extent of	Nil	Nil	Nil
Immunity against polyvalent virus is broken by polyvalent virus	15%		
Immunity against polyvalent virus is broken by Tzaneen virus to the extent of	50%	12%	—
Immunity against polyvalent virus is broken by virus collected from relapse cases in the Transvaal ...	59%	11%	
Immunity against polyvalent virus is broken by virus collected from spontaneous cases in the Transvaal ...	70%		
Immunity against polyvalent virus is broken by Bulawayo to the extent of	100%		

This shows that a polyvalent virus, although it did not completely prohibit a reaction from its constituents, prevented mortality. It further shows that it was equally as good as the ordinary virus since it completely protected against that one.

The fact that polyvalent virus did not protect against all of the constituents, as it should have done, shows that in passing the polyvalent virus through a horse one or more of the vira must have been excluded from the mixture with which the horse was injected.

For the year 1907-08 the polyvalent virus was introduced into practice, and 2,419 mules were inoculated. The season was not a severe one, but, notwithstanding this, 18 deaths occurred after discharge = 0·7 per cent.

One particular instance proved to be of an extraordinary interest. In Potgietersrust, out of a number of animals which were immunised in this particular way, 11 died after discharge. With our experimental experience at our disposal, we were not able to explain this mortality, thinking at the time that not all the mules had become immunised.

Accordingly, we sent 20 of our own mules to that particular locality, which had previously been immunised by us with the same virus, and the result was that one animal contracted horse-sickness and died. On the other hand, we took a number of animals that had been running in Potgietersrust down to Pretoria and tested them with the same virus, with the result that they resisted the inoculation, showing that they were really immune against horse-sickness, and

that the breakdowns in immunity were due to a new attack of horse-sickness. In other words, in a certain locality where the immunised mules were exposed, one particular strain of virus may have been existing against which our immunity did not hold good.

Thus our experience proves that the polyvalency of the virus does not give complete immunity, and is not yet sufficient for practical purposes. Accordingly, we again decided to increase the polyvalency of the virus by introducing into it, in addition to the strains with which we have inoculated hitherto, such other strains as have broken the immunity, and, in adding to the strain of polyvalent virus the new vira of relapses, we hope to finally arrive at a virus which will give immunity against any strain of the country. Experience, however, will have to show whether a complete immunity is possible or not.

Since the introduction of the polyvalent virus was followed by a slight increase of mortality from the inoculation it can reasonably be expected that, with the increase of the polyvalent virus, the mortality from the inoculation may also increase, and it remains to be seen whether the improvement in immunity can be given without incurring too much risk of mortality at the time of inoculation.

* * * *

The question may perhaps suggest itself whether an immunity of an animal can be increased by the repeated injection of different strains of vira at intervals, and the following table may prove interesting:—

PERCENTAGE OF REACTIONS AND DEATHS AMONGST IMMUNISED MULES WHEN SUBSEQUENTLY TESTED.

Number of Test.	Reactions.	Deaths.
1st	2·4%	1·8%
2nd	2·8%	Nil
3rd	1·9%	0·7%
4th	2·5%	0·3%
5th	1·2%	0·3%
6th, 7th, & 8th	Nil	Nil

From the above it is evident that reactions and deaths only cease after the fifth test.

* * * *

At the commencement of this article I alluded to the opinions of the farmers that animals which recovered from dik-kop are better salted than those which have recovered from dun-kop. Naturally, statistics will decide this question, and, from our experimental animals, we are able to compile the following:—

(a) 16 per cent. of inoculated mules show dik-kop during treatment; 84 per cent. of inoculated mules show dun-kop during treatment.

(b) When mules that have salted from the "dik-kop" form are tested at a later date, 8 per cent. show dik-kop again, and 21 per cent. show dun-kop.

(c) When mules that have salted from the dun-kop form are tested at a later date, 4 per cent. show dik-kop, and 28 per cent. show dun-kop.

Thus it will be seen that animals that have recovered from the dik-kop form may still contract dik-kop later, and that the percentage of relapses in "dik-kop immune mules" is only slightly less than in "dun-kop immune mules." But the number of "dik-kop immune mules" showing subsequent relapses with dik-kop is 50 per cent. greater than the number of "dun-kop immune mules" showing subsequent relapses of dik-kop.

The case of Mule No. 2214 is particularly interesting; this animal was inoculated with Tzaneen virus and gave a reaction accompanied with the symptoms of dik-kop; subsequently it was tested with ordinary virus and again gave a reaction accompanied with dik-kop; it was then exposed to natural infection near Pretoria, and showed another relapse with dik-kop present for the third time.

The following table may perhaps prove interesting as demonstrating the variation in relapses amongst inoculated mules in the several districts of the Transvaal.

PERCENTAGE OF MORTALITY OCCURRING AFTER DISCHARGE IN THE VARIOUS DISTRICTS AMONGST SOME 9,000 IMMUNISED MULES EXPOSED TO NATURAL INFECTION FROM SEPTEMBER, 1906.

Barberton	3%
Waterberg	3%
Lydenburg	2%
Rustenburg	2%
Piet Retief	2%
Middelburg	1%
Potchefstroom	1%
Pretoria	1%
Zoutpansberg	1%
Ermelo	Nil
Heidelberg	Nil
Marico and Lichtenburg	Nil
Standerton	Nil
Witwatersrand	Nil

* * * *

Conclusions.

(1) The experience in practice has shown that an inoculation of mules with any of the virus used, protected against death to the extent of 1·3 per cent.

(2) The immunity is by no means absolute.

(3) Breakdowns vary in the different districts, and even in the same locality.

(4) In the Laboratory we were able to break the immunity given by almost any virus, with blood obtained from immunised animals that died from horse-sickness after exposure.

All these facts prove the truth of the observation made by the South African farmer many years ago, and which he sums up in his remark that "a horse may be salted for one district or for one locality, and is not salted for another."

The Economical Use of Water for Irrigation.

By F. A. Hurley, A.M.Inst.C.E., F.C.H., Chief Engineer, Irrigation Department.

In a short article printed in the *Agricultural Journal* of October, 1908, it was stated that, in general, the tendency of irrigation is to use more water than is necessary for the proper development of crops, and, therefore, to use it uneconomically, and a few simple methods of gauging the quantity of water flowing in furrows were given, so that a farmer can determine for himself the amount of water being used by him at any given time. To have acquired the art of applying water to crops at the right time, and in the best manner, is to be a good irrigator. To handle water so that the soil shall not be unnecessarily washed or puddled or the crop injured or given too much or too little water, requires intimate acquaintance with local conditions, judgment, and patience. It is not possible to learn this art, any more than it is possible to learn how to make good bread, from books. There are, however, certain general principles which are capable of being stated, and which, if once understood, form a groundwork which enables the practical details to be more quickly learnt.

There are various methods by which the water led to the ground in furrows can be used to soak it, and different crops require different amounts of water, and require it to be applied at different intervals of time and in special ways. Certain soils, such as sand, loam, and light earth, will absorb large quantities of water in a short time and quickly become dry again, whilst clay and black peaty soil receive the water slowly, and, when soaked, retain it for long periods. Both the crop and soil must, therefore, be considered when determining the amount of water to be used in each case, and the exact quantity required can only be determined by experience, but until the experience has been gained there is a strong tendency *to use too much water.*

All crops derive their moisture from their roots, and, therefore, the better the roots are developed, the more chance there is of a good crop being obtained. Soil saturated with water retards root development, while half saturated soil is most favourable to their growth, and, therefore, to that of the plant.

In order to use water economically, it is of the highest importance that the condition of the soil to be irrigated should be such as to conserve its moisture for the longest possible period, and to reduce evaporation from its surface to a minimum. The first essential point is that land to be irrigated should be deeply ploughed and properly prepared and cultivated so that it is sufficiently open and porous to permit of the water penetrating into it; the second is that evaporation should be decreased by producing a proper tilth by cultivation; and the third is that the surface of the soil should be properly prepared and graded so that irrigating water shall not run off its surface. Every drop of water which flows from the surface of the soil is an indication that the latter is not in a proper physical condition.

Of the various methods of applying water to the land, there are only two that will, for the present, be generally applicable, namely (a) the flooding method, (b) the furrow method.

The flooding method may be accomplished in three ways depending on the character of the crop and the slope of the soil:—

(1) Flooding by simply leading a furrow along the highest portion of the land and allowing water to run from this freely over the land.

(2) Flooding by checks, by dividing sloping surfaces with a series of level benches by means of check levees* and allowing the water to stand in these.

(3) Flooding by the checker board system, by dividing nearly level ground into squares by levees and allowing the water to stand in these.

The furrow may be used in three ways:—

(1) By running small furrows close to fruit trees, etc., and allowing the water to percolate from these to the roots.

(2) By running water in small streams through the drills between such crops as potatoes and mealies and thus gradually moistening them.

(3) By drilling grain in rows or shallow furrows and running the water through these. This is practically a combination of flooding and sidewise soakage.

The preparation necessary for the ground will depend on the kind of irrigation to be practised. The greatest care should, however, be taken in preparing the land for irrigation, as it will be found that a little time and trouble spent on the work at the beginning will be amply repaid by the saving of water and the ease with which it can be applied. Once the land has been properly prepared it is not a difficult matter to keep it in proper condition.

Where water is applied by the flooding method, it is of the greatest importance to have a uniform slope and surface. This can be done by means of some of the grading tools now on the market. If the surface is flat, deep ploughing, followed by harrowing and then dragging some such tool as a dam-scraper over the land, will suffice. If the surface is not flat, the slope may be so great that if water were flooded on to it, the velocity would be so great as to erode the soil. This can be corrected by grading the surface so as to form checks. If, however, the surface of the soil within the checks is uneven, some portions of it will become saturated by forming pools, while the high parts will remain dry, and it is, therefore, only by proper attention to the preparation of the surface that the flooding method can be satisfactorily used.

When the soil has to be prepared for irrigation by furrows, it is necessary to be equally careful. If the small furrows (say, between rows of potatoes), are too steep, the water will run too quickly and erode the soil, whereas, if they are not steep enough, the water may take so long in flowing across the field that it is all evaporated or absorbed before it reaches the lower end.

* Small embankments for confining irrigating water. (See Plate 25.)

Sidelong Flooding.—The first-mentioned method of flooding consists of simply letting the water run over the land from a cut or outlet in the main furrow, and is the method most usually adopted in this country. The water then flows on the land in a thin sheet. This method is very wasteful of water.

Flooding by Checks.—This consists of running check levees round the slope of the land on contour lines. They should be low banks of earth about 6 inches to a foot in height, such as can be turned up by a plough and placed at such distances apart, varying with the slope of the ground, that the crest of each shall be on a level with the base of the check above it. The water is run from the main furrow in smaller ones crossing these checks and diverted into them in turn.

When one check is full the water is drawn off to the next lower level, or, if the soil is sufficiently porous, it is allowed to stand until it has been absorbed. (Plate 25.)

Flooding by the Checker Board System.—This is merely an elaboration of the check system consisting in dividing fields into squares or rectangular figures separated by checks and admitting water to one square at a time, and either allowed to soak into he soil or drawn off for use in the next lower square.

This system is not so convenient as the check system as the great number of checks (unless the squares are very large, which is possible only on very flat ground) interferes with ordinary farming operations.

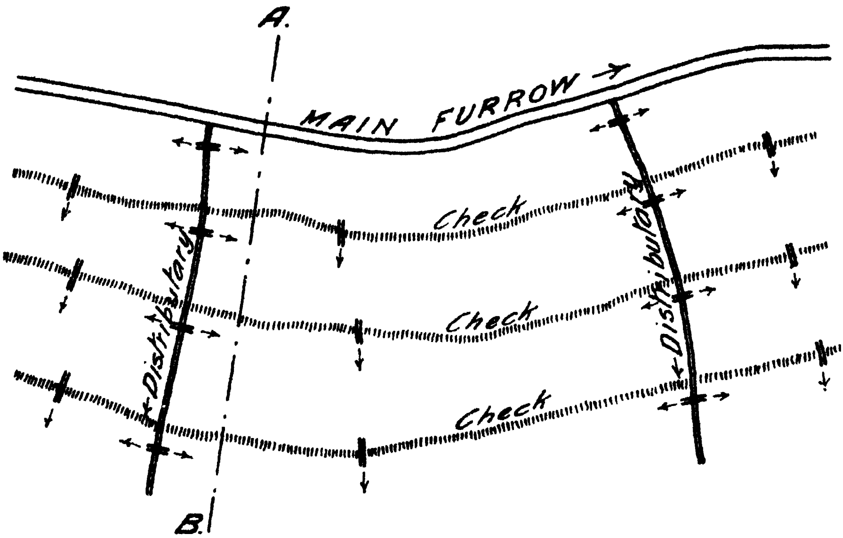
Irrigation by Furrows.—Irrigation by the furrow method hardly needs any description; it consists in passing water from the main furrow into smaller ones, and from these into still smaller furrows or drills between rows of crops, and is, of course, most easily applicable only to such crops as are usually sown in rows.

The main furrow will, of course, follow a level contour at the highest level of the land to be irrigated, the smaller furrows leading from the main furrow should, for preference, follow such a line that land can be irrigated on both sides of them. They should have, if possible, a uniform slope and depth, or, if the ground slope is too steep to admit of this, small falls should be introduced at intervals. The drills between the crops should be such that the water can be diverted into them from the distributory furrows by means of temporary obstructions in the distributory furrows. (See Plate 26.)

The secret of successful irrigation is close attention to the area to be irrigated. Twenty acres of irrigated land closely attended to and properly looked after will be more profitable than double that area superficially cared for. In order to secure the best results the following are the main points to be observed:—

(*a*) Prepare the land carefully for the kind of irrigation that it is intended to practice. Plough deep and make the soil sufficiently porous for water to find its way well down to where the roots of the crops should be.

SKETCH "A"



SECTION ON A-B.

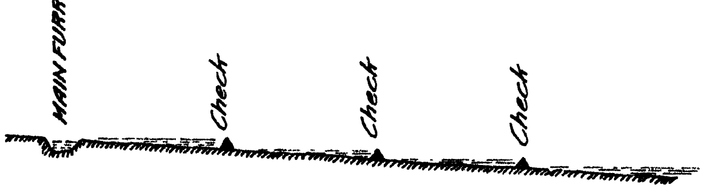
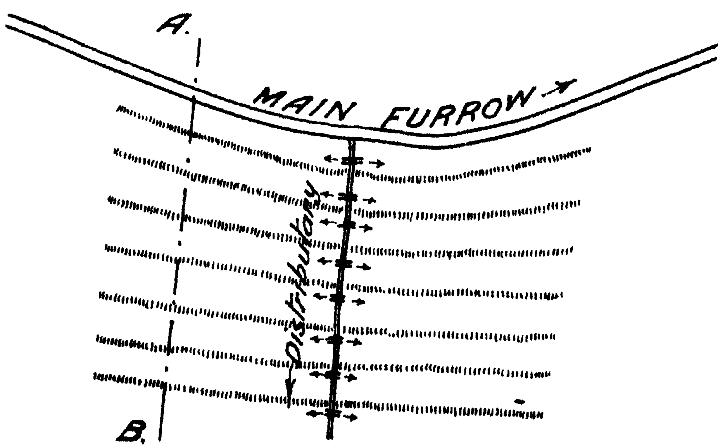


Plate 25.

SKETCH "B"



SECTION ON A-B.

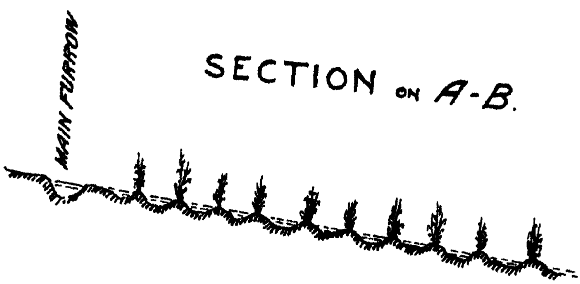


Plate 26

(*b*) Give the land a good soaking at each irrigation, and *do not irrigate too frequently*, for if the land becomes too saturated plant growth is retarded.

(*c*) If possible, cultivate the land after an irrigation, so as to reduce loss by evaporation.

(*d*) Try to use as little water as possible consistent with keeping the soil *at or near the roots of the plant* moist. Few farmers, when water is plentiful, are likely to make the mistake of giving their crops too little water, whilst the mistake of over-watering is only too common.

A Note on the Poultry Industry of England and South Africa.

By Major Hunnebeg.

It may be safely assumed that poultry has been known and kept for domestic purposes since long before the Christian Era, but it is only within the past century that careful attention has been paid to any breeds with the exception of the game fowl, which was kept for fighting purposes. One of the earliest English books dealing with fowls is quoted by Brown as being written by Sir Anthony Fitzherbert, and entitled the "Boke of Husbandry," published in 1532. A hundred years later, in 1631, Gervasse Markham's "Cheap and Good Husbandry, for the well ordering of all Beasts and Fowls" was published. In this volume prominence is given to domestic poultry, but only a brief description of the game and "dunghill cocke." A great impetus was given to poultry keeping in England by the advent of the cochin china fowl. The first specimens of this breed were received by Her Majesty Queen Victoria in 1845, and never before or after this time has the importation of a single breed of fowls caused such a boom in the poultry world. The hens were said to lay several eggs per day, and, for that time, most fabulous prices were paid. £40 for a cock and £5 for a setting of eggs was no uncommon figure. In 1853 the first brahmas were imported into England, and then the so-called "hen fever" began to rage all over the country, and, in time, spread to America, whence the first importation of this breed had been made. People then began to take an interest in poultry, and shows were held all over the country and poultry clubs were formed.

In 1865 the first attempt was made in England to judge by a fixed standard, and, in 1886, the Poultry Club issued its first standard of perfection. There were only thirteen breeds of fowls dealt with in that work. In 1901 a new standard was published "containing a complete description of all the recognised varieties of fowls."

When it is remembered that there are at present no less than 81 breeds of domestic fowls, with 187 sub-varieties, known, it will be seen that a competent poultry judge who is able to deal with all of them must be a very accomplished individual. Besides these particular fowls there are twelve varieties of ducks, twelve varieties of geese, and seven varieties of turkeys.

The impetus given to poultry breeding in England soon spread all over the world. Although poultry breeding in England on systematic and rational lines was, at first, mainly confined to what is known as "fancy birds," the large amounts of money annually sent abroad for eggs soon induced people to take up poultry keeping for egg production. And, in spite of the fact that the value of imported eggs has gone up from £835,028 in 1864 to over £8,000,000 in 1907, there is no doubt that the production in England, and especially in Ireland, has also increased tremendously during that time. Societies for the improvement of the laying and table qualities of fowls have been formed which, at the same time, also see that

facilities are created for the disposal of eggs and poultry by bringing producer and consumer into touch with one another.

The National Poultry Organisation Society of Great Britain has done, and is still doing, a splendid work in this direction. England stands at present pre-eminent as the country containing and producing the best poultry in the whole world. America comes next as a good second, and other countries (which at present do not reach that standard of good quality which obtain in the two just mentioned) are making rapid strides towards the improvement of the quality of their poultry.

* * * *

Let us now turn to South Africa.

Natal.—The poultry industry in South Africa was first placed on a firm basis in Natal by the formation of the Natal Poultry Club at Pietermaritzburg in 1884. The first show of this club was held in December, 1885, and since that time, with the exception of one year, an annual show has been held. Having quite a number of their members at Durban a show was held in that town in May, 1888. A separate club, called the Durban and Coast Poultry Club, was formed by coast fanciers and breeders in 1898, but it was not until the year 1906 that an additional club was formed in Natal at Newcastle.

It must not, however, be overlooked that all the Natal agricultural societies, before the advent of the poultry clubs, had always made very liberal provisions in prizes for their poultry sections, and they are still doing so. To Natal belongs the credit of having first introduced into South Africa a number of new breeds, such as orpingtons, barred and white plymouth rocks, brown, buff, and black leghorns, wyandottes, etc. Nor should one omit to mention that all these breeds were introduced very shortly after they made their original appearance. For a long time the Natal breeders supplied pure-bred fowls to the whole of South Africa, but, with the northern extension of the Cape railway, a considerable decrease in their exportations took place. Even, however, at the present day, Natal is still well able to hold her own in competition with the rest of South Africa in both fancy and utility classes.

Cape Colony.—The first poultry show in the Cape Colony, as far as I can ascertain, was held at Capetown in 1893, and it was followed by East London in 1897, Kimberley 1899, Port Elizabeth in 1903, Kingwilliamstown 1904, Queenstown 1904, Uitenhage 1905, and Kokstad in 1906. Further shows were recently held at Worcester and in the suburbs of Capetown. As in Natal, so also in Cape Colony, the agricultural societies always provided for special poultry sections at their annual shows. More especially, at the annual grand shows held at Rosebank and at Port Elizabeth.

Orange River Colony.—In this Colony the first poultry show was held in 1904, and this has since become an annual event. There are some ardent fanciers amongst the leading men of that Colony, and quite a large export trade in poultry and eggs generally is done from the Orange River Colony to the Transvaal.

Rhodesia.—Rhodesia has also formed a poultry club recently. I have, however, no particulars as to their shows.

Lourenço Marques.—Although, strictly speaking, not in South Africa, this part of the world may also be counted inasmuch as a poultry club has been formed there which is affiliated with the Transvaal organisation.

Transvaal.—In our own Colony poultry clubs existed before the war, but they were not purely poultry clubs as some of them comprised other sections.

The first real poultry club after the war was formed in Pretoria in 1903; a most successful show was held in that year, and has been repeated annually since. In conjunction with this club branches were also formed at Gezina, Brooklyn, and Cullinan, and most satisfactory shows have been held at these three places. Johannesburg also formed a strong club, and held its first show in 1903. The shows held by the Rand Poultry Club have become events of South African importance. Both Potchefstroom and Pietersburg held their first poultry shows in 1906, and the East Rand Poultry Club, with headquarters at Germiston, held their first show in 1907. This having proved a most satisfactory event, it was repeated this year with equal, if not greater, success.

The Transvaal Wyandotte Club, with headquarters at Johannesburg, was formed in 1906, and held its first show in Pretoria in conjunction with the Transvaal Poultry Club in 1907, and its second show in June of this year in conjunction with the East Rand Poultry Club at Germiston.

In January, 1904, on the invitation of the Griqualand West club, a poultry conference was held at which the following clubs were represented: Pretoria, Johannesburg, Bloemfontein, Kimberley, Capetown, Port Elizabeth, Kingwilliamstown, East London. At this conference the South African Poultry Association was formed for the purpose of bringing into line the various clubs in South Africa. The headquarters of the Association were fixed at Kimberley, but subsequent conferences were held in 1905 at Johannesburg, in 1906 at Kingwilliamstown, in 1907 at Port Elizabeth, and in 1908 at Pietermaritzburg.

Principally owing to the ringing question, but also to the general apathy shown by the secretaries of several of the affiliated clubs, the affairs of the association could not be carried on satisfactorily, and, at the last conference at Pietermaritzburg, the constitution of the association was remodelled on new lines, and each Colony has now its own poultry union, with the association as governing body for the whole, the Capetown Club having seceded altogether from the association. Such, briefly, is the history of poultry culture in South Africa.

The clubs are sustained by members' subscriptions and Government grants and such other revenue as they derive from entrance fees for exhibits at their shows, gate moneys, sales of catalogues, and special donations. The three shows held at Pretoria, Johannesburg, and Germiston, during 1908, must certainly be counted as amongst the most successful in South Africa both as regards the quantity and quality of the exhibits.

Although it may be safely affirmed that the poultry clubs have been, and are, most useful and valuable educational institutions, their influence has not as yet permeated the country as one would wish. We still send large sums of money out of the country for eggs and poultry, and I have not yet seen a decent table-bird sold on any of our markets. Nor are we alone in this state of affairs, the same conditions prevail in our Sister Colonies.

An Experimental Poultry Farm, under the management of an expert, was established by the Transvaal Government in 1903 at Potchefstroom, and many pure-bred birds have been distributed throughout the country through the agency of this valuable institution. Furthermore, all the agricultural societies in the Transvaal provide a most liberal classification in the section of their prize lists set apart for poultry.

Poultry literature in South Africa is represented by the *South African Poultry Journal,* which was established, I believe, in 1903. It is issued at Durban, and has done much to disseminate knowledge on poultry matters throughout South Africa. Further, quite a number of the daily papers contain weekly or bi-weekly articles on poultry keeping. Several new ventures, dealing purely with poultry matters, have made their appearance more recently.

The newly established *South African Agriculturist and Stock Breeder* has also set apart portion of its space for articles on poultry, and the various Government agricultural journals contain timely and instructive articles on the poultry industry.

That industry, I am sorry to say, is not as yet in a flourishing state, and so long as the farmer does not understand that a hen is really a money-making machine, if properly and rationally treated, so long will we have to import eggs and poultry from other countries. Lectures should be delivered wherever possible, and whenever convenient, not only in towns but on farms wherever an attendance (even if it is a very small one) of some of the farmers can be counted upon. Of late we hear much of local industries. Well, here is one at hand which, in other countries, has been made one of the sources of the national wealth and of the well-being of the people, but which, in this Colony, is still in a most primitive state. Let us hope that it will soon grow to large numbers and great importance.

Agricultural Endowments in America.

By William Macdonald, M.S.Agr.

"Every coin spent in cultivating ground is a direct gain to the whole nation."—Ruskin.

It is said that when the great warrior Xerxes was advancing against Athens, at the head of his irresistible hosts, to avenge the burning of Sardis—at the selfsame time when the brave Leonidas and his three hundred men were engaged in their deathless struggle in the defile of Thermopylæ—he learned from some Arcadian spies that the Greeks were engaged at that very moment in celebrating their famous games in the fertile valley of Olympia; and, being interested, the Persian General asked for what prize they strove. "A crown of Olives." "Heavens!" was the reply, "What manner of men have we come to do battle with—men who contend not for gain, but for glory?"

In the following pages we shall set down the career of three "swift runners" in the race of life, who, scorning the vulgar prizes of material gain, have yet won a high place in the annals of American agriculture. We speak of Morrill, and Hatch, and Adams.

Justin S. Morrill, author of the famous Morrill Act, and founder of the American Agricultural Colleges, the son and grandson of a blacksmith, was born in the village of Strafford, in the little State of Vermont, on 14th April, 1810. And it is of interest to remember that his great contemporary, the sixteenth President of the United States, Abraham Lincoln, came into the world in a log cabin in the backwoods of Kentucky just fourteen months before. Like Ezra Cornell, Justin was the eldest son of a large family, and so, at an early age, inured to habits of both industry and thrift. He picked up as best he could a very fragmentary education in the district school until he was fourteen years of age.

His services were then needed to assist in the support of the growing family, and so he started life in the village store at a salary of $30, or £6, per month. Six years later he was made partner in the business, and after some fifteen years of active and successful business operations he was able to retire with a modest fortune. Like a wise man, he purchased a tract of land, built a house, married a wife, and settled down to spend the rest of his life in the undisturbed enjoyment of rural pursuits.

His career seemed finished. But it was not so. In the year 1854, Mr. Morrill was asked to stand as the representative of Orange County, and, after a close contest, he was elected by a majority of fifty-nine votes; and then, strangely enough, he entered upon what was to be the longest—and also one of the most fruitful—careers in the whole history of Congress. For twelve successive years Mr. Morrill was sent to the House of Representatives with large majorities, and, in 1867, transferred to the Senate, where he served continuously for thirty-two years, thus constituting an unbroken legislative record of forty-four years. Although Mr. Morrill was the author of several important Bills, his permanent fame will for ever rest upon the Land Grant Act of 1862.

On December 14, 1857, Mr. Morrill, then a member of the House of Representatives from the State of Vermont, introduced a Bill into the Lower House authorising the establishment of Industrial Colleges in every State, and granting for their maintenance 20,000 acres of the public land for each member of Congress. This Bill passed both Houses, but was vetoed by President Buchanan. Again, in December, 1861, Mr. Morrill brought in his amended Bill, which bestowed upon the several States 30,000 acres* of land for each member of Congress for the establishment of colleges to teach such branches of learning as are related to agriculture and the mechanic arts, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life.

* * * *

The law† which now stands on the statute book of the United States marked the close of a long struggle waged by Mr. Morrill for nearly five years in the face of bitter opposition. Senator Clay, of Alabama, characterised the Bill as "one of the most monstrous, iniquitous, and dangerous measures which had ever been submitted to Congress"; and Senator Rice, of Minnesota, in the spirited language of the West, said that "he looked upon the success of this measure as bringing a slow, lingering death to Minnesota." Moreover, it is instructive to note that this Act was devised by a man who never had the advantage of a college training. He was thus free from the narrowing prejudices which such an education sometimes produces; while, on the other hand, he was both by sympathy and upbringing a plain man of the people, setting forth their dim ideas in clear and effective speech.

At the time of the Morrill Act agriculture was the one great industry of the country, and, consequently, the idea of "agricultural education" appealed strongly to the popular mind; but Senator Morrill on several occasions stated the real purpose of his measure. On one occasion he said:—

> It is perhaps needless to say that these colleges were not established or endowed for the sole purpose of teaching agriculture. Their object was to give an opportunity for those engaged in industrial pursuits to obtain some knowledge of the practical sciences related to agriculture and the mechanic arts, such as they could not then obtain at most of our institutions called classical colleges, where the languages, Greek and Latin, French and German, absorbed perhaps two-thirds of all the time of the students while in college.
>
> But it was never intended to force the boys of farmers going into these institutions so to study that they should all come out farmers. It was merely intended to give them an opportunity to do so, and to do so with advantage if they saw fit.
>
> Obviously, not manual but intellectual instruction was the paramount object. It was not provided that agricultural labour in the field should be practically taught any more than the mechanical trade of a carpenter or a blacksmith. Secondly, it was a liberal education that was proposed. Classical studies were not to be excluded, and, therefore, must be included. The Act of 1862 proposed a system of broad education by colleges, not limited to a superficial and dwarfed training such as might be had at an industrial school, nor a mere manual training such as might be supplied by a foreman of a workshop or by a foreman of an experimental farm. If any would have only a school with equal scraps of labour and of instruction, or something other than a college, they would not obey the national law. Experience in manual labour, in the handling of tools and implements, is not to be disparaged; in the proper time and place it is most essential, and, generally, something of this may be obtained either before or after the college term, but it should not largely interfere with the precious time required for a definite amount of scientific and literary culture, which all earnest students are apt to find far too limited.

* The amount of land actually allotted to the several States was partly determined by the value of the land selected.

† See Appendix III.

So clear was Mr. Morrill on this matter that in the title of the Bill, which he again introduced in 1873, he called these institutions "National Colleges for the advancement of general scientific and industrial education"; and he was wont to say that the name "Agricultural Colleges" would never have been applied save that it suited the casual convenience of an index clerk.

It may be doubted whether the States which accepted the Congressional grant had any clear conception of what it really meant; but the measure was verily the most important step which had yet been taken towards the realisation of that grand idea formulated by Jefferson, namely, of a school system in every State, starting with the Primary School and reaching up to a State University—*all to be non-sectarian, scientific in method and aim, and supported by public taxation.**

The success of the new institutions was not gained everywhere without a struggle. They were required to teach experimental science without proper buildings or apparatus. Another and more serious obstacle was the lack of trained teachers; also the jealousy and antagonism of various institutions already established. The opposition to the new colleges was based on the same theory, and supported by the same arguments, as those which were wont to be urged against the State control of elementary and high schools; but in spite of every form of impediment the public mind of America has at last grasped the great principle that there is no logical *stopping place between the State support of elementary education and the State support of the highest University education.*

THE SECOND MORRILL ACT (1890). †

With the establishment of the Experiment Stations, the cause of agricultural education received a profound stimulus, and it soon became evident that the Land Grant Institutions in many States were unable to meet the call for technical education. At this moment Mr. Morrill came forward with a proposal to increase the endowment of the Land Grant Colleges out of the national funds arising from the sale of public lands. His Bill for this purpose passed both Houses of Congress, and was approved by President Harrison on the 30th of August, 1890. This Act provides for an annual appropriation as follows:—

To each State and Territory for the more complete endowment and maintenance of colleges for the benefit of agriculture and the mechanic arts now established, or which may hereafter be established, in accordance with an Act of Congress approved 2nd July, 1862, the sum of $15,000 (£3,000) for the year ending 30th June, 1890, and an annual increase of the amount of such appropriation thereafter for ten years by an additional sum of $1,000 (£200) over the preceding year, and the annual amount to be paid thereafter to each State and Territory shall be $25,000 (£5,000) to be applied only to instruction in agriculture, the mechanic arts, the English language, and the various branches of mathematical, physical, natural, and economic science, with special reference to their applications in the industries of life and to the facilities for such instruction.

Thus, under the second Morrill Act, each Agricultural College now receives from the Federal Government an annual appropriation of $25,000 (£5,000).

Further, in March, 1898, Mr. Morrill introduced a Bill providing that whenever the proceeds of the sales of public lands should be less "than is required by the terms of the Act aforesaid (the Act of 1890) to be

* "The Legislative Career of Justin S. Morrill," page 22. by George W. Atherton, LL.D.

† By the Act of 1862, 30,000 acres were donated to each State for each Senator and Representative in Congress to which it was entitled. By the Act of 1890 each State received an equal appropriation.

paid to each of the several States, any deficiency shall be paid from any money in the Treasury not otherwise appropriated." Mr. Morrill did not live to see this Bill become law, but a like provision has since been passed by Congress; and the Colleges, after an eventful period of forty-six years, are now firmly established in the educational system of the United States.

* * * *

This sketch of the life and work of Senator Morrill would be incomplete without a short statement respecting the growth and present status of the Land Grant Colleges. It should be borne in mind that the Act of 1862, passed by the National Government, did not directly donate the lands to the States, but merely offered them on certain plainly specified and somewhat stringent conditions. How magnificent has been the response of every State and Territorial Government will be seen by the following statistics:—

The land granted to the States was rather more than ten million acres.* And educational institutions deriving funds from the first and second Morrill Acts are now established in all the States and Territories of the Union, with the exception of Alaska, Hawaii, and Porto Rico. The full number of these institutions is sixty-five, and the present value (1906) of their permanent funds and equipment is estimated at $84,195,385 (£16,839,077). In the same year their income is set down at $13,546,759 (£2,709,351); whilst a census of their students reveals the astonishing figure of 56,919, with a staff of teachers numbering 4,687 persons. It is, therefore, plain that these Colleges have met a great public need. Nor is it too much to say that they have profoundly influenced the whole realm of higher education by reason of the wide range of their curriculum and the sterling quality of their scholarship.

The annalist of American agriculture will doubtless accord to Morrill a high place amongst the many illustrious citizens of the great Republic. But were it otherwise, we firmly believe that his renown will be for ever cherished in the hearts of those students who daily pass through the spacious portals of his splendid colleges; for he, more than any other of his eminent contemporaries, threw wide open the gateway to distinction, and made possible to the poorest lad on the pathless prairie those avenues of learning which lead alike to fame and fortune.

Let us now turn to the second great endowment fund. In his message to Congress, in the year 1796, President Washington pleaded for the establishment of a National Board of Agriculture, one of the functions of which would be to "encourage and assist a spirit of discovery and improvement by stimulating enterprise and experiment." But ninety-one years were to elapse before the great statesman's idea was to be fully realised in the favourable report of the Agricultural Committee on the Bill introduced into the House of Representatives by Mr. William H. Hatch, of Missouri, and finally approved by President Cleveland on 2nd March, 1887.

On the establishment of the United States Department of Agriculture in 1862, the adjoining grounds were used as an Experimental Farm. And as soon as the Agricultural Colleges were founded, experimental

* The total number of acres of land granted to the States under the Act of 1862 was 10,320,842, of which 798,053 acres are still unsold.

investigations in the field and laboratory were undertaken; but for many years these investigations were carried on only in a small way, and for the most part as a voluntary labour of love by the professors—outside their regular duties. However, the report of the classic researches of Gilbert and Lawes at Rothamstead, in England, excited a lively interest in America, and the more advanced agricultural leaders began to ask for the establishment of similar institutions in the United States.

In 1875 the first State Agricultural Experiment Station in America was established at New Haven, in Connecticut; and, notwithstanding the severe financial depression which occurred shortly after, we note that the Legislature passed a permanent annual appropriation of $5,000 (£1,000) "to promote agriculture by scientific investigation and experiment."

The success which attended this attempt to establish a State Experiment Station within the precincts of historic Yale led to a friendly rivalry amongst the colleges; and thus, four years later, the Cornell University Experiment Station was organised by the Agricultural Faculty of the University. Other stations were soon established, and the interest of practical farmers, as well as of men of science, was aroused by the reports of the results of these stations. So it happened that in July, 1885, a Convention of Agricultural Colleges and Experiment Stations met in the Department of Agriculture, in the City of Washington, in response to a call issued by the Commissioner of Agriculture. Almost the first thing which this Convention did was to adopt a resolution "that the condition and progress of American agriculture require national aid for investigation and experimentation in the several States and Territories." So earnest were the members of this Congress that they were able within nine months to secure the passage of the now famous Hatch Bill through an Agricultural Committee of the House of Representatives.

The Hatch Act provided that $15,000 (£3,000) per annum be given out of the Federal funds proceeding from the sale of public lands to each State and Territory for the establishment of an Agricultural Experiment Station, which must be a department of the Land Grant College established under the Act of Congress of 2nd July, 1862, except in the case of those States which had established Experiment Stations as separate institutions prior to the passage of the former Act. Furthermore, in order that the funds from the National Treasury might be for the most part devoted to agricultural investigations, only $3,000 (£600) of the first year's appropriation for each station was to be expended for buildings, and thereafter only $750 (£150) a year could be so expended.

And now a word as to the statistics of those Experiment Stations established by the Hatch Act, which are now found in all the States and Territories as well as in Alaska, Hawaii, and Porto Rico. The total number of stations is 63, while the income in 1906 was $2,017,492, of which $960,000 (Hatch Fund $720,000 and Adams Fund $240,000) was received from the National Government, the remaining million odd dollars coming from the various State Governments. The stations employ 950 persons in the work of administration and inquiry; and last year published 463 annual reports, bulletins, and circulars, which were supplied to over 758,000 addresses on the regular mailing list.

Who, then, was the author of this Bill? William Henry Hatch,* father of the American Experiment Stations, lawyer, soldier, and legislator, the son and grandson of a physician, was born in Georgetown, Kentucky, on the 11th September in the year 1833. We are told that as a child William Henry was of an affectionate disposition, being specially fond of animals and plants, and all those things that are found in the fields of the country-side. And we need hardly wonder that forty years of farm life left a vivid impression on the mind of this man, and marked him out pre-eminently as the wise and the sympathetic friend of the farmer.

His school career was brief and uneventful. At an early age he went to Richmond, a town in Kentucky, where he earned a living in a drug store, and at the same time studied law in the office of a certain judge. At the age of twenty-one he was admitted to the bar; soon after, however, he migrated to the State of Missouri, and four years later was elected to the post of circuit attorney.

But this was the sad and stirring period of the Civil War, and Mr. Hatch left his peaceful pursuits to follow the fortunes of the Army of the South. He was appointed to the rank of captain in 1862; and a year later made commissioner for the exchange of prisoners of war. In this office he had to supervise the exchange of prisoners at Richmond, in the State of Virginia; and, it is said, that in the discharge of this duty he showed a kindness and consideration that endeared him alike to his friends and to his foes. A little later he was promoted to the rank of lieutenant-colonel.

In 1878 Mr. Hatch was elected to Congress, and served continuously for sixteen years, during which time he was the promoter of several important measures for the benefit of the agricultural industry. But he will be best remembered as the father of the Experiment Station Bill. His political life was characterised by a lofty integrity, a firm conviction, and all the charm of a winning personality. Hatch was twice married, and died in December, 1896, near the town of Hannibal, in the State of Missouri.

* * * *

The third great endowment fund is that which is now known as the Adams Act; and it may be of interest to set down the salient facts concerning the career of the author of this far-reaching measure.

Henry Cullen Adams was born in Verona, Oneida County, New York, on 28th November, 1850, and was taken by his parents to Wisconsin the following year. He received his early education at the Albion Academy and the University of Wisconsin, and later engaged in dairying and fruit growing. In the year 1883 he was elected a member of the State Assembly. For two years he was actively engaged in the work of the Wisconsin Farmers' Institutes, and served as President of the Wisconsin State Dairymen's Association, and as Secretary of the State Horticultural Society. For seven years he held the post of State Dairy and Food Commissioner, in which position he accomplished much good work.

Like most great measures, the origin of the Adams Act had a small beginning. The story is as follows:—The Association of Agricultural Colleges and Experiment Stations had just closed its seventeenth Annual

* The writer desires to acknowledge his indebtedness for information regarding the life and work of Hatch and Adams to Dr. W. A. Henry, Director of the Wisconsin Agricultural Experiment Station, and also to Dr. A. C. True, Director of the Office of Experiment Stations Department of Agriculture, Washington, U.S.A.

Convention in Washington. Amongst the delegates was Professor W. A. Henry, Dean of the College of Agriculture in the University of Wisconsin. Dr. Henry became ill, and, being unable to return home, he lingered on in Washington. One day—to be precise, on the 20th November, 1903—he made his way to the Capitol building, and there met Mr. Adams and Mr. Henry Casson, Serjeant-at-Arms of the House of Representatives. At that meeting Dr. Henry spoke of the vast amount of good which had accrued from the original Hatch Act, but emphasised the present poverty of the Experiment Stations—how agricultural research was languishing for want of funds—and closed his argument by stating that what the Experiment Stations needed was another gift like the Hatch Act. Mr. Adams grasped the point at once, and closed the discussion by saying: "Another grant to the stations would be a righteous measure. Congress will pass such a Bill. It can be done."

It is unnecessary to speak of the many details of this Bill, which makes an annual appropriation for the Experiment Stations. Suffice to say that is was revised by Dr. A. C. True, of the Office of Experiment Stations, and met with the cordial support of the members, and was passed by the House of Representatives one day in February, 1906. Its record in the Senate was equally encouraging, and on March 16, 1906, President Roosevelt approved the Act by which the National Government will set aside each year $700,000 (£140,000) for agricultural research, or double the original Government grant.

The Adams Act provides that each State and Territory shall annually receive from the National Treasury a grant of money in addition to that given for the establishment and maintenance of agricultural Experiment Stations by the Act of 2nd March, 1887 (Hatch Act). The initial appropriation to each State under the Adams Act was $5,000 (£1,000) for the fiscal year 1906. To this amount $2,000 (£400) is to be added each year for five years, after which an appropriation of $15,000 (£3,000) is to continue annually. Accordingly, the several States and Territories received a sum of $240,000 (£48,000) in the year 1906.

Furthermore, the new Act recognises that—through previous National and State legislation—the stations are now thoroughly organised, equipped with land and buildings, and have certain funds for the printing and distribution of publications. Consequently, the further extension of the experimental work of the stations is made the sole object of the Adams Act, and the additional funds are "to be applied only to paying the necessary expenses of conducting original researches or experiments bearing directly on the agricultural industry of the United States." The Adams Fund is thus essentially a research fund, and, if properly used, should produce results of the greatest and most permanent value to American agriculture.

Mr. Adams was an incorrigible optimist, and it was well so, for he was an invalid. The sickness which interrupted his university course dogged—like a grim spectre—the whole span of his life. How he lived so long, and did so much, was as great a mystery to his friends as it was a triumph to his own indomitable will. But when we recall that the blood of such statesmen as John Quincey Adams and Daniel Webster flowed in his veins, we need wonder less that in the brief space of three years in Congress he was able to introduce a measure which is destined to exercise a profound influence on the progress of American agriculture, and which will for ever link the name of Representative Adams, of Wisconsin, with that of Senator Morrill, of Vermont, and William H. Hatch, of Missouri.

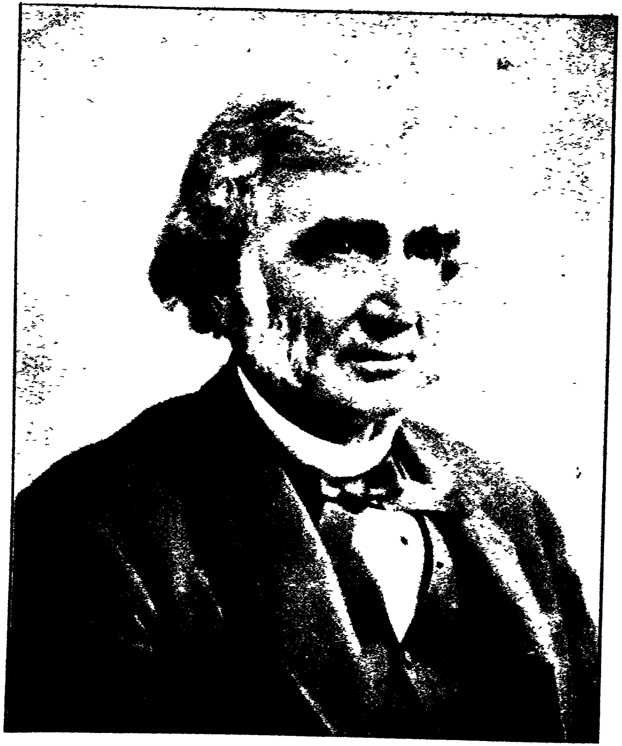
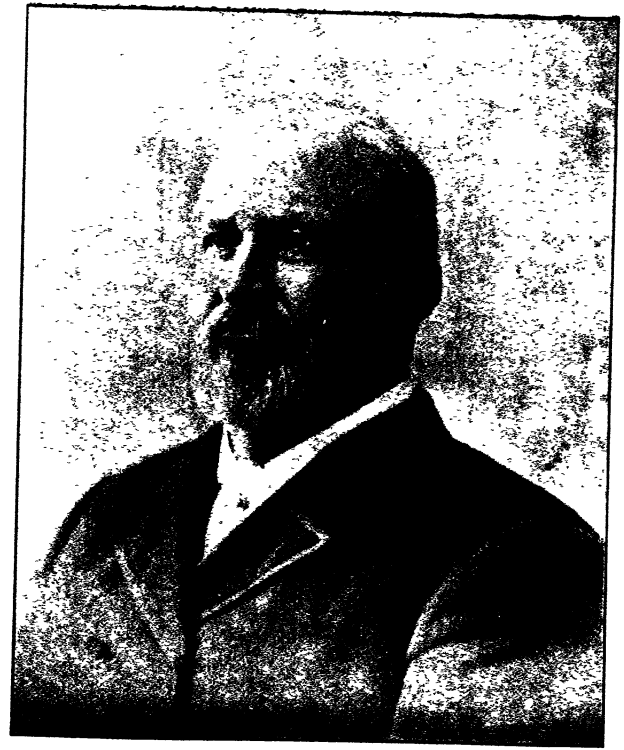


Plate 27. SENATOR J. S. MORRILL.
(Father of the American Agricultural Colleges.)



HON. WILLIAM H. HATCH.
(Father of the American Agricultural Experiment Stations.)

The Veterinary Section.

LUNG-SICKNESS OR CONTAGIOUS PLEURO-PNEUMONIA OF CATTLE.

By J. M. CHRISTY, Assistant Principal Veterinary Surgeon.

THE Transvaal is to-day practically free from this disease, yet the statement that nearly every South African farmer has had practical experience of it at one time or another is substantially correct, and this is sufficient evidence that it can flourish here and cause as great loss to stock owners as it has in other countries; therefore, the present moment appears opportune to direct the attention of the readers of the *Agricultural Journal* to some of its more interesting historical and general features, if by so doing we sound a note of warning and strengthen their determination and vigilance to keep it out of the country for all time. Several of the other South African Colonies are not so fortunately situated as the Transvaal as regards the prevalence in them of this disease, and as we import daily hundreds of cattle, it behoves us to be very careful or we may have lung-sickness once more rampant in our herds, causing much loss and inconvenience to all concerned.

Every one interested in the cattle industry of the Transvaal is, or should be, aware of the regulations in force to keep out lung-sickness. One of our great safeguards is that no cattle are allowed into the Transvaal from a Colony in which lung-sickness exists, unless the animals are certified free from disease, and come from a property where no contagious disease of animals existed for a period of at least three months prior to the date of such certificate, signed by a Government Veterinary Surgeon of the Colony from which the cattle come. I may say that this regulation has now been in force for close on two years, and that during that time we have not, so far as is known, imported one diseased head of cattle; this reflects great credit on the veterinary staffs of the other Colonies, and I think the very best thanks of all of us are due to those gentlemen for the careful and conscientious way in which they have carried out their duties.

Lung-sickness is a contagious disease of cattle, the organs attacked being the lungs and their surrounding envelop—the pleura. The exact organism that causes lung-sickness was for a long time in dispute, but Roux and Nocard demonstrated it to be a microbe, whose size is so small that it is barely visible under the highest power of the modern microscope. This organism is difficult to keep alive, and can only be grown on special media; this fact is of great practical interest, as it helps to support the opinion of most practical men that the disease can only be spread by actual contact of diseased or recovered animals with healthy ones. Further, it supports what has been noted in practice, that the disease shows no tendency to linger in sheds or cow-houses once they are cleared of infected animals.

The history of lung-sickness, unlike anthrax and some other well-known diseases, is not very ancient. The first account of its appearance

dates from 1693, when it was observed in Hesse, and at the beginning of the eighteenth century it was prevalent in Switzerland, Baden, Württemberg, and Alsace. From 1790 it spread over the whole of Germany, France, and Italy, and by 1800 had invaded all the countries of Western Europe. It appeared in England in 1735. During the ten years from 1840 to 1850 it spread to America, South Africa, and Australia. It ravaged the herds of Great Britain and Ireland for over a century and a half, causing loss that no statistician has been able to estimate, but running into millions of pounds sterling. Eventually the radical process of killing off all herds in which the disease appeared had to be adopted. This had the desired effect, and for the past ten years Great Britain and Ireland have been free from this bovine pest. Switzerland adopted a somewhat similar policy to that of Great Britain and Ireland, with a like satisfactory result.

Many Continental countries have adopted most stringent quarantine and other palliative measures, but in none of them has complete success crowned their efforts, at which fact none of us who have had the privilege of making post-mortems on the in-contacts of slaughtered-off infected herds are surprised, when we remember the great number of lungers found that appeared perfectly healthy during life. The principle that underlay the stamping out process was that a herd once badly infected was liable always to remain so on account of the presence in it of lungers, and was a danger not only to its own individual members but to every herd of cattle that came in contact with it. That this was correct in Great Britain and Ireland few who had much to do with the disease there will, I think, be found to deny, but the case is somewhat different in the high dry climate of the Transvaal, where cattle spend the greater part of their lives in the open veld and not in crowded pastures or cowsheds. Cases have come under my notice in the Transvaal where I could only assume that the disappearance of the disease from a herd or section of a country was due to the fact that affected animals recovered spontaneously without any assistance from man, and lost the power of transmitting the disease—in other words, that though some animals got the disease in a virulent form and died, others got a mild attack, recovered from it, and after a time were unable to transmit the infection of it to susceptible animals.

To cite one case out of a number which came under my notice, in 1902 I was in Secucuni Land, Lydenburg District, inoculating cattle against rinderpest, which was very prevalent there at that time, and found a large number of cattle suffering from lung-sickness. I was able to make a number of post-mortems at various kraals, and the disease appeared to be of a most virulent type, yet it has died out in Secucuni Land, though no active measures have been taken, so far as I know, to check it. If it still remained in Secucuni Land I think we would be sure to know of it, as officers of the Veterinary Division have had many opportunities in the past few years of examining the herds there and of making post-mortems on cattle dead from or destroyed on account of East Coast fever.

We must not, however, look on lung-sickness as a disease to be lightly treated even in the Transvaal, for if it gets a hold here it will exact its annual death-roll, and, further, if we are ever to do a cattle export trade, even with the surrounding Colonies, it will be to our advantage to be able to point out that lung-sickness at least cannot be got from our territories.

From a State Veterinarian's point of view, lung-sickness has two peculiarities that cause him trouble and anxiety: the first is its long and indefinite incubation period, and the second the fact that a perfectly healthy-looking animal may be what is termed a "lunger," and be capable of spreading infection. However, the palliative treatment of inoculating the in-contacts helps us somewhat here, as it has been noted that in a lunger as a rule the inoculation does not take, or the animal develops an acute attack of the disease; further, an animal in the incubative stage of the disease, if inoculated, frequently develops an acute attack. In the Transvaal quarantine of the infected herd is compulsory, also inoculation of all the in-contacts, and these regulations appear to give fairly satisfactory results.

The Chemical Section.

NOTES FROM THE CHEMICAL LABORATORIES.

By Robert D. Watt, M.A., B.Sc., Acting Chief Chemist.

I.—Nitrification in Transvaal Soils.

Most people are accustomed to look on the soil as a dead thing—a lifeless, inert mass—and, even in these days of popular science, many would be surprised to hear that an ordinary soil is literally teeming with unseen forms of life. Nevertheless, it is true that in one pound of surface soil there may be anything from 4,000,000 to 2,000,000,000 microbes present, and in soil to which stable manure has been recently added the number may rise to 40,000,000,000 per pound.

When a farmer becomes convinced of the existence of these myriads of organisms in his soil, he will naturally wish to know whether they are his friends or his enemies. If they are his friends, he will wish to encourage them; if his enemies, he will endeavour to find means for their destruction.

Our knowledge of soil bacteria is still comparatively meagre, but we do know this, that there are many different kinds of bacteria or microbes in soils, some of which are harmful and some helpful to the farmer in his growth of crops, and that the latter are probably the more numerous and important. The groups of bacteria which have been most carefully studied are those which are concerned in the changes undergone by the important element nitrogen. For instance, it is a matter of common knowledge that certain bacteria work in co-operation with leguminous plants like lucerne, beans, peas, and clovers, that these bacteria help the plants to obtain their supply of nitrogen from the air, and that they are sometimes added artificially to soils by inoculating the seeds or watering the plants with cultures of these organisms.

It is not so generally known, however, that there exist in a great many soils in different parts of the world bacteria which fix the nitrogen of the air without the aid of leguminous plants; nor is the ordinary farmer so familiar with the organisms which bring about "nitrification," yet the existence of these microbes in soils is of the utmost importance.

Those who have had previous experience of temperate countries must have noticed how much more quickly organic matter—in the form of plant and animal remains—disappears from the soil in a semi-tropical country like the Transvaal. Now this organic matter has to undergo quite a long series of changes in the soil before it becomes available as "food" for plants, and these changes are mainly the work of some of the bacteria of which I have spoken.

The mealie stalks, stable and kraal manure, etc., which get mixed with our soils usually become transformed into a stuff called "humus," which is the cause of the darker colour of the surface

soil. This is changed by bacteria and other organisms into compounds of ammonia, which are in turn acted upon by other bacteria and changed into what are known as nitrates. This last process is known as "nitrification," and the organisms which bring it about are called "nitrifying" organisms. The importance of nitrification will be understood when I say that it is almost exclusively in the form of nitrates that all ordinary farm crops, except legumes, take up their nitrogen.

With a knowledge of the rate at which organic matter disappears, it seemed to me a matter of considerable importance to ascertain whether the nitrifying organisms were present in our soils, and whether they were present in an active state, especially as their scarcity had been hinted at by previous writers. I cannot here give the details of my researches, but I think my experiments have proved conclusively that not only are the nitrifying bacteria present in abundance, but they are in a state of great activity, and I have been forced to the conclusion that, with the higher temperature in the Transvaal, nitrification proceeds much more rapidly here than in temperate countries. This is corroborated by the fact that many of our sandy soils, which on analysis are shown to be very poor in nitrogen, are capable of growing quite good crops.

There is, however, one factor in our climate which might be supposed to have a retarding effect on the organisms, namely, our long winter drought. I therefore examined a number of unirrigated soils early in September for the existence of the nitrifying organisms, and in every case I found that they were present in a fairly active state, and that their products—nitrates—existed in the soil. Of course the weather conditions this year were somewhat abnormal, as we had a considerable fall of rain in July. In order, therefore, to still further test the drought-resisting capabilities of the organisms, I examined some soils which had been kept in an "air-dry" state in tightly-corked bottles in our laboratories for over five years, and in every case the organisms were found to be present. As only traces of nitrates were present in these soils, I concluded that the organisms were in a resting state, and this confirms the results of other experimenters who have found that nitrification does not go on in "air-dry" soils.

In only two soils in the whole course of my experiments did I fail to find the bacteria in abundance. Both of these were "vlei" soils, which had probably been in a water-logged state for years, and which contained too much organic matter, and too little lime, to promote nitrification.

This leads me to the practical point, namely, the part the farmer can play in encouraging nitrification. To understand this, we must consider what are the conditions most favourable to the life of these particular bacteria.

First of all they must have something to feed on, i.e. there must be some organic matter present in the soil. Thus the use of moderate quantities of stable and kraal manure, the ploughing in of mealie stalks and other plant refuse, and particularly of leguminous plants,

all encourage the process, though the presence of a large excess of organic matter, as in peaty soils, has been shown to be harmful.

The presence of a sufficient quantity of moisture, though not enough to cause water-logging, is also important. The process is also encouraged by the free admission of air to the soil. These two conditions can be brought about by deep and thorough cultivation.

Another factor which is less under the farmer's control is the temperature of the soil. There is little danger, even in this Colony, of the temperature of the soil getting too high for the growth of the organisms, but their activity is checked if the temperature gets below 5° above the freezing point.

Lastly, nitrification cannot go on in acid soils, so that the addition of lime is necessary before the process can go on actively in many of our soils, and the beneficial effect of adding lime is more often due to its effect in encouraging nitrification than to its direct action as "food" for plants.

II.—The Percentage of Water in Soils at the end of the Dry Season.

In the beginning of September my attention was called to the "dry land" winter wheat plots at Skinner's Court. One half of the plots looked much more vigorous and healthy than the other half The only difference in treatment had been that the plot which was looking best had been harrowed once some time after the wheat was sown, whereas the other part had received no form of cultivation

On the 4th September I took samples of soil from each plot, and determined the percentage of moisture present, with the following result:—

		Moisture.	Average
Uncultivated Soil	Top 12 inches	8·66 per cent.	10·47 per cent.
	12 inches to 24 inches ...	12·28 „	
Harrowed Soil ...	Top 12 inches	9·92 „	10·43 „
	12 inches to 24 inches ..	10·94 „	

There was thus only a slight difference between the amounts of water in the two soils to a depth of 2 feet, and the smaller percentage of water present in the soil which had been harrowed would be more than accounted for by the larger quantity of water which must have passed through and been "transpired" by the larger crop. There was, however, over 1 per cent. more moisture in the surface soil where the land had been harrowed. As very few of the roots reached a depth of more than a foot, the slightly higher percentage of moisture in the surface soil in the case of the harrowed plot doubtless accounted directly or indirectly for the increased crop.

The nitrifying powers of the two samples of surface soil were tested, when it was found that the cultivated soil was better supplied with the nitrifying organisms than the other, probably chiefly owing to the slightly higher percentage of moisture. If a single harrowing produces an appreciable difference in a winter-grown crop, what might thorough and systematic cultivation do, especially if there should happen to be a fall of rain during the winter?

III.—An Exceptionally Rich Soil.

We recently analysed for a correspondent a sample of black soil from the neighbourhood of Machadodorp, which proved to be very rich in nitrogenous organic matter. The following table shows the result of our analysis, together with similar figures for the average of 100 typical Transvaal soils:—

	Machadodorp Soil.	Average Transvaal Soil.
Moisture ...	8·22 per cent	2·10 per cent.
*Organic matter ...	28·89 ..	5·84 ..
Insoluble matter (sand, etc.) ...	56·16 ..	79·88 ..
Oxide of Iron and Alumina ...	5·79 ..	11·09 ..
Lime ...	0·96 ..	0·24 ..
Magnesia ...	0·37 ..	0·15 ..
Potash ...	0·07 ..	0·19 ..
Phosphoric Acid ...	0·03 ..	0·055 ..
	100·19	99·845
Containing Nitrogen...	1·098 per cent.	0·111 per cent.
"Available" Potash ...	0·0062 ..	0·0113 ..
"Available" Phosphoric Acid ...	0·0120 ..	0·0069 ..

The Machadodorp soil, therefore, contains nearly ten times as much nitrogen as an average Transvaal soil. It is also rich in lime, though rather poor in potash and phosphoric acid. These latter, especially the phosphoric acid, are, however, in a very "available" condition, so that this land ought to be capable of producing good crops without manure for a long time to come. Of upwards of 500 Transvaal soils which we have analysed, this is the second richest in nitrogen, being only surpassed in this respect by a peaty soil from Irene, which contained nearly 60 per cent. of organic matter.

IV.—Eucalyptus Oil.

Two samples of locally-manufactured eucalyptus oil were submitted to us for analysis some time ago. One was found to be of very high purity, while the other was only of medium quality, but could probably be brought up to the necessary standard of purity by redistilling. It is interesting to find that we have in the Transvaal not only the raw material, but the knowledge necessary, for the starting of a new industry, even although it is not a very large one.

V.—Discovery of Phosphatic Deposit in Natal.

Attention has been repeatedly called in this *Journal* to the small proportion of phosphoric acid or phosphates in our soils, and to the benefit to be derived from the use of phosphatic manures for almost any crop, or almost any soil, in this Colony. Our only natural sources of this important manurial ingredient are bones and bat's guano. The value of bones is beginning to be more generally recognised, and the manufacture of bone dust and dissolved bones is on the increase owing to the greater demand for them.

Deposits of bat's guano are frequently being discovered, and these should prove useful for farmers in the neighbourhood of the caves, though, as a general rule, they are not worth transporting to any great distance.

We have continually been on the look out for natural deposits rich in phosphates, but hitherto without success. At last, however, a fairly rich deposit has been discovered near Weenen, in Natal. Samples have been examined by Mr. Ingle, formerly Chief Chemist to the Transvaal Department of Agriculture, and by Mr. Pardy, the Natal Government Analyst, and the bulk of the material has been found to contain almost 25 per cent. of phosphoric acid.

The deposit may be utilized in two ways. It may either be ground into a fine powder and applied direct to the soil, in which case its action would be very slow, or by treatment with sulphuric acid it may be converted into superphosphate, which is the most quick-acting of all phosphatic manures. It is not rich enough to make the high-grade superphosphate, containing 37 to 39 per cent. of soluble phosphate, which is generally used in South Africa, but would be capable of giving rise to a superphosphate containing 25 per cent. of soluble phosphate. As sulphuric acid is manufactured both in Natal and in the Transvaal, the manufacture of superphosphate can be carried on fairly cheaply without the importation of any raw material.

The deposit exists chiefly in the form of nodules of various size, and evidently stretches over a large tract of country. It is estimated that there is sufficient to supply the requirements of South Africa for phosphates for many years. Whether the Transvaal will greatly benefit by the discovery depends on the price at which the superphosphate can be landed here. In any case, if the matter is properly taken up, the value of this deposit to the farmers of South Africa cannot be small, and in the meantime we would congratulate what we must still designate as "our sister Colony" on her good fortune.

VI.—Feeding Value of Different Varieties of Mealies.

Some time ago we received from the Division of Botany several samples of mealies for analysis. As the feeding value of maize grain depends almost entirely on the percentage of protein it contains, this ingredient only was determined. The following shows the result of our analysis of the eighteen varieties, given in order of merit:—

Variety.	Character of Grain.	Colour of Grain.	Shape of Grain.	Protein.
Improved Early Horse-tooth ...	Dent	White	Narrow	10·47 per cent.
Thorough-bred White Flint ...	Flint	"	Broad	10·43 "
Wood's Northern White Dent ...	Dent	"	"	10·43 "
White-cap Dent	"	Yellow and white	Narrow	10·25 "
Early Star Leaming ...	"	Yellow	"	10·07 "
Extra Early Huron Dent (I) ...	"	"	"	10·06 "
Extra Early Huron Dent (II) ...	"	"	"	9·93 "
Yellow Hogan	"	"	"	9·91 "
Iowa Silver Mine	"	White	"	9·90 "
Champion White Pearl	"	"	"	9·86 "
Hawksbury Champion	"	Yellow	"	9·69 "
Hickory Horse-tooth	"	White	"	9·64 "
Austin's Colossal	"	Yellow	"	9·61 "
Hickory King (good sample) ...	"	White	Broad	9·34 "
Chester County Mammoth ...	"	Yellow	Narrow	9·30 "
Hickory King (crossed)	"	White	Broad	9·01 "
Golden King	"	Yellow	"	8·98 "
Wisconsin White Dent	"	White	Narrow	8·58 "

It is unfair to judge any particular variety of mealies by a single analysis, but the above figures will give a rough idea of the relative feeding value of those tested.

It is noteworthy that the only flint variety examined comes out second highest in the list. This is quite in agreement with previous analyses of Transvaal mealies made by this Division, the results of which showed that the average protein content of three samples of flint mealies was 10·89 per cent., whereas the average of six samples of dent mealies was 9·42 per cent.

Reference to the list will show that the colour of mealies is no guide as to their feeding qualities.

There is an idea in some quarters that a broad type of mealie, like Hickory King, is of higher feeding value than the narrow wedge-shaped type. This is not borne out by the analysis, as all the broad dent varieties, except Wood's Northern White Dent, are very near the bottom of the list. The average protein content of the four varieties of the broad type is 9·44 per cent., whereas the average of the thirteen wedge-shaped varieties is 9·77 per cent. It is hoped that in the near future a more exhaustive series of analyses of Transvaal mealies may be carried out, as the results would be a guide to farmers for growing mealies for home consumption.

HINTS ON THE FEEDING OF FARM ANIMALS.

By Robert D. Watt, M.A., B.Sc., Acting Chief Chemist.

In response to the appeal of numerous correspondents I have agreed to put in more popular form the result of our own and other people's researches into the composition of the common foodstuffs of the farm. This I have attempted to do by means of a series of diagrams showing the composition of some of the commoner feeding-stuffs, and, to make the treatment of the subject a little more complete, I have added some general remarks on the feeding of animals.

Functions of Food.

The energy required for the performance of work, the heat necessary to keep the animal body at the required temperature, the materials for the building up of new tissue have all one origin, and one only, namely, the food of which the animal partakes. Further, it is only that part of the food which is digested and absorbed into the system of the animal which can be of use in performing these functions. It is not only when it is doing active work like pulling a plough that an animal requires food as a source of energy, as the mechanism of the animal is never at rest, and energy is required for the pumping of the blood through the body by the heart, for certain necessary movements of the internal organs connected with the digestive processes and other purposes. Of course, the more work an animal is doing the more food it requires, and, on the same principle, animals require more food to keep up the heat of the body to the normal standard in winter than in summer. Naturally, also, if a cow is giving milk, an ox or pig is laying on fat, or a young animal is increasing in size and weight, they require more food than would be necessary for a mature animal of equal weight which is only being maintained in life.

2

Composition of Feeding-Stuffs.

The result of the analysis of a food as usually stated requires a little explanation, as each ingredient has a separate function, and the whole art of feeding largely depends on the proper blending of foods so as to give the proper relative amounts of the different ingredients. The following six items are usually found in any statement of the composition of a feeding-stuff :—

I. Moisture.
II. Ash or mineral matter.
III. Protein or crude albuminoids.
IV. Crude Fibre.
V. Fat or ether extract.
VI. Soluble carbohydrates or nitrogen-free extract.

With the exception of the first, the various items do not represent single definite compounds, but are rather groups of substances having a similar composition or similar functions. A short explanation of the nature and functions of the several items is necessary to a proper understanding of their relative importance.

I. Moisture.

This is simply ordinary water, and it makes up more than half of all succulent parts of plants, and quite a considerable portion of grains and other dry products. Its amount in foods varies from less than ten per cent. in dry grains and fodders to over 90 per cent. in the case of mangels and turnips. If the animals have access to an abundance of good water its value in a foodstuff is practically nil, though it has been found that the mixing of succulent foodstuffs with dry meals, grains, and chopped fodders causes the animals to make better use of the latter, and, of course, where the supply of water is scarce succulent foods are very valuable as part of the ration.

II. Ash.

The ash of any foodstuff is the residue left on burning. It varies greatly in amount and character in different classes even of dry foodstuffs ; for example, ordinary mealie grain contains only 1·5 per cent. of ash, whereas lucerne hay contains nearly 9 per cent. The chief function of the ash constituents is the building up of the bone framework of the animal, though they are also necessary for the formation of the ordinary animal tissues, for the blood, the digestive juices, the production of milk, etc., and these special functions cannot possibly be performed by any other of the food constituents. As has been hinted, equal quantities of ash have not the same value in all feeding-stuffs. Thus, the ash of leguminous fodders like lucerne is much more valuable for bone nutrition than that of cereal straws and grasses, as a large proportion of the latter consists of silica, which is practically valueless. For bone formation the two most important ingredients of the ash are lime and phosphoric acid. For young, growing animals, and to a less extent for mature animals, the relative as well as the total amounts of these two substances have been shown to be of importance. By reference to Plate 30 it will be seen that milk, which is Nature's food for the young animal, is well supplied with both, considering its watery nature, and that the excess of phosphoric acid over lime is not great.

Now, it has frequently been pointed out in previous publications by this Division that lime is often present in relatively small amount in the common foodstuffs of the Transvaal, and that there is an apparent connection between this state of things and the prevalence of certain bone diseases, such as osteoporosis. The remedy for this defect seems to lie, not so much in liming the soil or even in providing licks as in the introduction into the animal's ration of foodstuffs rich in lime like the leguminous fodders. Plate 30 shows at a glance how much richer in lime lucerne, cowpeas, and velvet beans are than grains like mealies or indeed any other group of feeding-stuffs. Another useful ingredient of the ash is common salt, which is necessary for the formation of the digestive juices, and the addition of this to an animal's diet as a lick or mixed with other foods is quite sound.

III. Protein.

This item does not represent a single compound, but a group of substances, all of which contain nitrogen—that all-important element which is always cropping up whether we are talking of soils, plants, or animals. Speaking generally, the protein is most valuable weight for weight when it occurs in seeds and grains and their products, less when in grass and coarse fodders, and least when in succulent roots like mangels. It is by far the most important ingredient of foodstuffs, as the nitrogen, which it alone of all the items in a food contains, is essential for the formation of that mysterious substance called protoplasm, round which the vital activities centre, and which Huxley has called "the physical basis of life." From the protein are formed the muscles and tendons, the skin, hair, horns, and hoofs, as well as the tissue of the most important organs; in short, protein is the source of all the working parts of the animal body, and the vigour and quality of any animal is largely dependent on a sufficient supply of this ingredient, especially in its early life. As a large proportion of the dry matter of milk and eggs consists of protein, which can only be derived from the protein in the food, it is particularly necessary that milch cows and laying hens should receive a sufficiency of food rich in protein. Even this does not exhaust its possible functions, as it can be used as a source of energy and heat, and even of fatty tissue.

A glance at the accompanying diagrams will show what foodstuffs are rich in protein. It will be seen that ordinary grains like mealies, oats, and wheat are fairly well supplied with it, that wheat bran contains more, but that the foodstuffs that are pre-eminent for their richness in this ingredient are the "oil cakes." It will also be observed that the leguminous fodder crops (lucerne, cowpeas, velvet beans) are richer in protein than oat-hay, and even than the cereal grains, though, as has been explained, the value of equal amounts of protein in grains and coarse fodders is greater in the former case. I am aware that the price of good linseed cake and decorticated cotton cake is very high in this Colony, and that it is not so easy to suggest a remedy for the admittedly low protein content of our ordinary feeding-stuffs. Our hope for the future seems to lie in the establishment of industries like cotton-growing and the manufacture of soap from the oil extracted from pea-nuts (ground nuts or monkey nuts), as the by-products of these would prove a great boon to dairy farmers and breeders of high-class stock.

IV. Crude Fibre.

This consists of the woody and fibrous parts of plants, and is mainly indigestible by animals like the horse and pig, though ruminants like the ox and sheep can make use of it to a certain extent. It makes up a considerable part of all coarse dry fodders, and the more mature the plants are the greater the proportion of crude fibre they contain. The husks of grains and seeds are largely composed of this substance, which accounts for the larger proportion contained in oats than in maize and wheat. It should not enter too largely into the diet of horses and pigs, but ruminants require a large bulk of food so that it is not objectionable in the food of cattle and sheep. When it is digested it performs the same functions as the carbohydrates, which will be described later.

V. Fat.

This is more correctly described as "Ether Extract," as, especially in green and dried fodders, it contains other substances besides fats and oils, e.g. resins, wax, and colouring matters. Its value is highest in milk and in grains and seeds, and lowest in green foodstuffs. Its chief function is as a source of energy and heat in the animal body, and it is also important in the formation of milk and the production of animal fat. It is, therefore, a valuable constituent of the ration of milk-producing and fattening animals and of working animals in cold climates and seasons. If we neglect the ash constituents, which are hardly comparable with the others, fat ranks next to protein in importance, and the large percentage in oil seeds like ground linseed is the chief cause of their high value. Even the residues from oil seeds are rich in fat, although with modern methods of extraction by chemical solvents the amount of oil in products like cotton cake and linseed cake is tending to diminish. In some form or other it is the chief constituent of "cream equivalents" sold for the feeding of calves. Where there is a good market for cream or butter it is the custom to feed calves with skim-milk or buttermilk, to which a food rich in fat like ground linseed is added to replace the cream which has been removed.

VI. Soluble Carbohydrates.

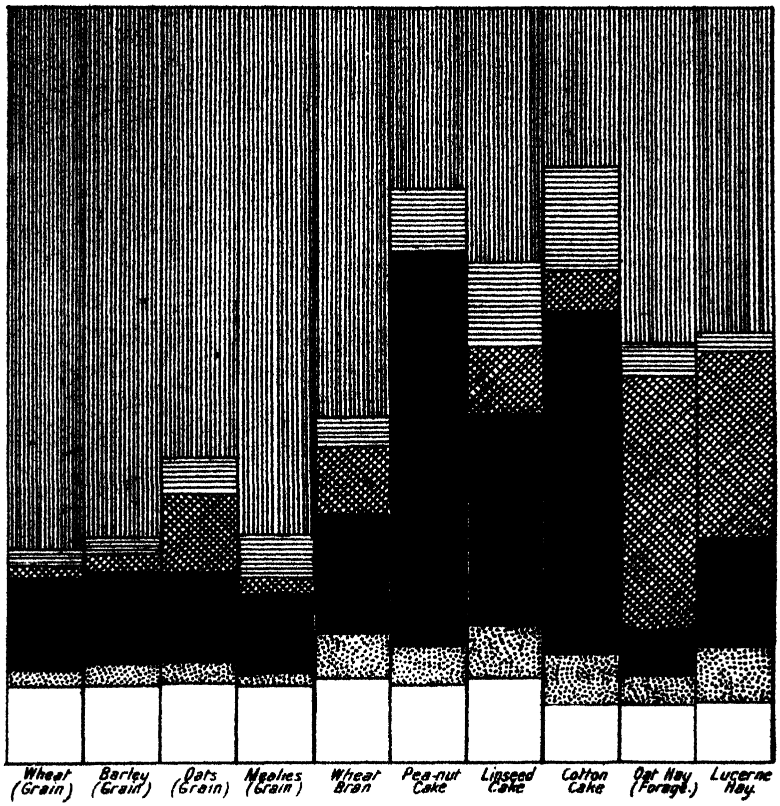
This group of substances includes sugars, starch, digestible cellulose, and other compounds, and has consequently different values in different feeding-stuffs. In roots like mangels, turnips, and sugar-beets the carbohydrate present is chiefly sugar, in potatoes, grains, and non-oily seeds it is mainly starch, while in grasses, straws, and hays it largely consists of digestible cellulose and pentosans, and it is consequently of most value in the first group, and least useful in the last group of substances. Carbohydrates perform the same functions as the fat, though their value is less than half that of the true fat for heat and energy production. They constitute more than half of the ordinary cereal grains (wheat and maize being specially rich in starch) and usually they make up a large proportion of the dry matter of all foods except oil-seeds and their products.

NOTES ON THE DIAGRAMS.

Now that we understand a little of what is meant by each item in the analysis, it will be interesting to have a closer look at the diagrams. A key to the markings representing the different constituents is provided, and the main function of each appended. (Plates 28, 29, 30.)

Plate 28.—Heading should read—"Diagram showing the Composition of some Transvaal Feeding-Stuffs."

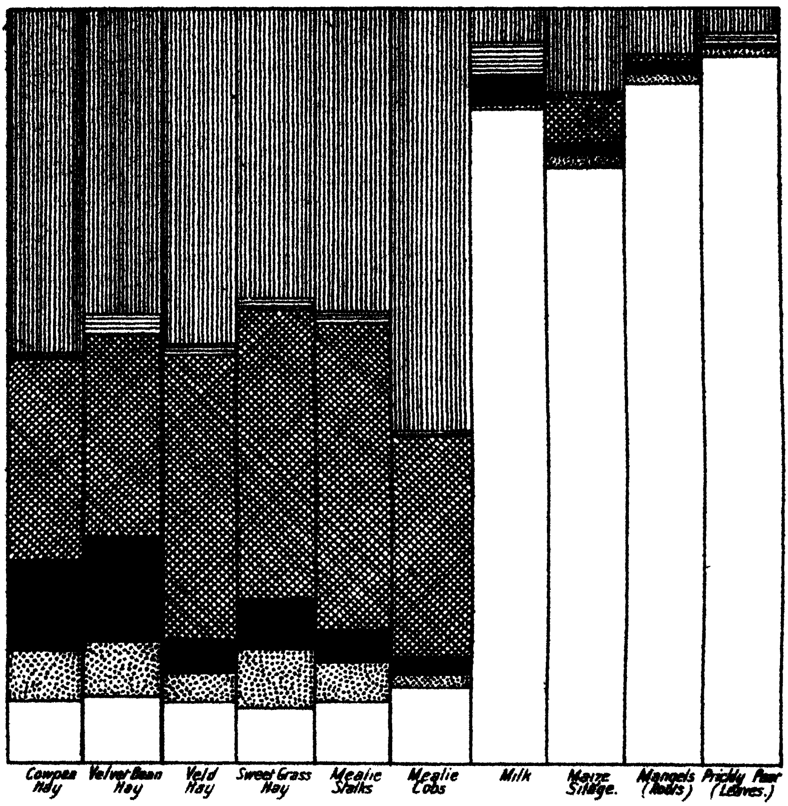
Diagram Showing Amounts of Lime and Phosphoric Acid in Equal Quantities of various Feeding-stuffs.



	Wheat (grain).	Barley (grain).	Oats (grain).	Mealies (grain).	Wheat Bran	Pea-nut Cake.	Linseed Cake.	Decorticated Cotton Cake.	Oat Hay.	Lucerne Hay.
Water	10·5	10·9	11·0	10·9	11·9	10·7	11·7	8·2	8·0	8·4
Ash (bone former)	1·8	2·4	3·0	1·5	5·8	4·9	6·7	7·0	4·2	7·4
Protein (musclè former)	11·9	10·5	11·8	10·5	15·4	47·6	28·0	45·0	5·7	14·3
Fibre (largely indigestible)	1·8	2·7	9·5	2·1	9·0	5·1	9·0	5·5	34·2	25·0
Fat (heat, fat, and energy producer)	2·1	1·8	5·0	5·4	4·0	8·0	11·4	13·5	3·9	2·2
Soluble Carbohydrates (ditto)	71·9	71·7	59·7	69·6	53·9	23·7	33·2	20·8	44·0	42·7

Plate 28.

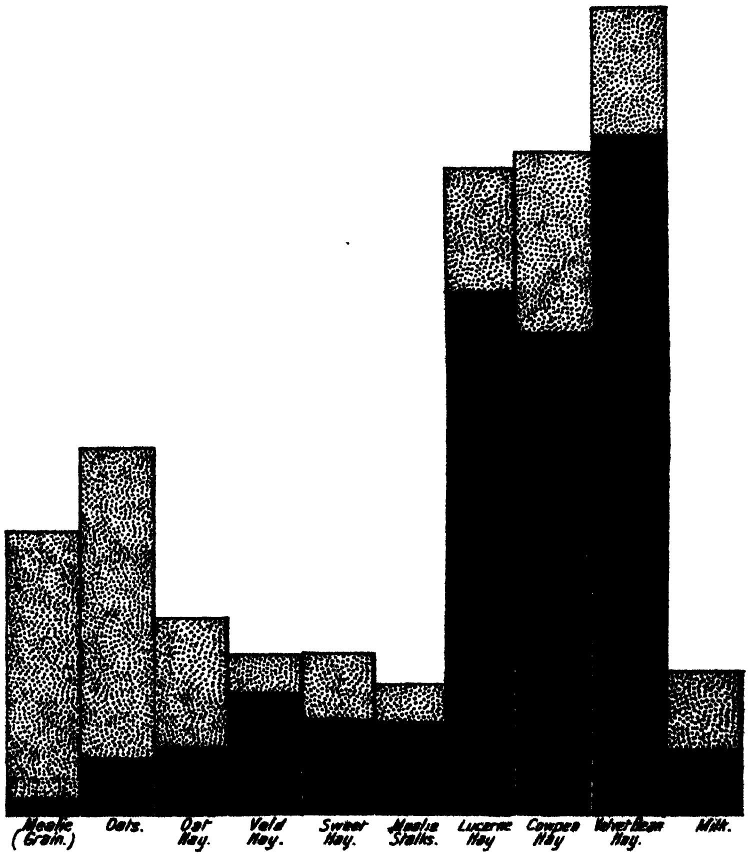
Diagram showing the Composition of some Transvaal Feeding-stuffs.



	Cowpea Hay.	Velvet Bean Hay.	Veld Hay.	Sweet Grass Hay.	Mealie Stalks.	Mealie Cobs.	Milk.	Maize Silage.	Mangels.	Prickly Pears.
Water	8·2	9·3	8·1	7·5	8·4	10·7	87·1	79·1	90·9	93·8
Ash (bone former)	6·3	7·8	5·4	8·1	5·2	1·4	0·8	1·4	1·1	1·1
Protein (muscle former)	14·4	13·3	3·4	7·6	4·5	2·4	3·5	1·7	1·4	0·4
Fibre (largely indigestible)	30·5	27·6	38·0	38·1	41·1	30·1	none	6·0	0·9	0·7
Fat (heat, fat, and energy producer)	2·4	2·6	1·2	1·1	1·5	0·5	3·9	0·8	0·2	0·1
Soluble Carbohydrates (ditto)	38·2	39·4	43·9	37·6	39·3	54·9	4·7	11·0	5·5	3·9

Plate 29.

Diagram Showing Amounts of Lime and Phosphoric Acid in Equal Quantities of various Feeding-stuffs.



The lime and phosphoric acid in the various food-stuffs are proportional to the following numbers:—

	Lime.	Phosphoric Acid.
Mealies (grain)	2	35
Oats (grain)	7	41
Oat Hay	9	17
Veld Hay	16	5
Sweet Grass Hay	13·5	9
Mealie Stalks...	10	8
Lucerne Hay...	69	16
Cowpea Hay	63·5	28
Velvet Bean Hay	90	16·5
Milk	8·1	11·7

Plate 30.

The first four foodstuffs whose composition is illustrated are cereal grains, and they show a great many points in common. They are all concentrated feeding-stuffs—too concentrated to form the sole food of ruminants. Moreover, they are well-balanced foods, and mainly digestible. Their chief drawback is their poverty in ash constituents, and this is specially true of maize, which will be found on reference to the last diagram to be particularly deficient in lime. Besides this, the ratio of protein to other substances is not quite satisfactory, especially in the case of mealies. Comparing the grains amongst themselves, it will be seen that wheat and oats are richer in protein than maize and barley, and that maize and oats are much richer in fat than the other two. Owing to the larger percentage of husks, oats contain more crude fibre than the others, and consequently less starch.

It will be noticed that wheat bran is richer in protein and ash than any of the cereal grains, the reason being that the protein in wheat is chiefly present in the layer immediately under the thin husk. The protein content, and, therefore, the feeding value of bran, varies greatly owing to differences in the amount of this layer which is separated with the husk. The more primitive the machinery used the richer the bran is likely to be.

If sufficient space had been available I would have put beans and peas next on the list, as they are intermediate in protein content between the grains and the oil-cakes. Peas contain about 20 per cent. of protein, and horse beans from 25 to 26 per cent. The notable feature about the "oil-cakes" is the large proportion of protein and oil which they contain. Though not such well-balanced foods as cereal grains, they are much more valuable than cereals for strengthening a ration which consists largely of foods poor in fat and protein. They are also richer in ash than the cereal grains.

As we pass from foods of the nature of grains and seeds to those which consist mainly of the leaves and stems of plants, we come to less concentrated foods containing more indigestible matter. Oat-hay (forage) is a well-balanced food, not containing a large excess of any ingredient for the requirements of animals, and being sufficiently bulky for consumption by horses. As the sole food of horses, it is perhaps better suited than any other *single* food, though confining an animal to one article of diet only is not to be recommended. Its chief defect is its poverty in ash, especially lime, and it is besides rather poor in protein to give the best results with animals doing hard work. If the oat-hay is supplemented by mealies it will be noticed that the combination is not an ideal one, as both have the same defects of poverty in lime and protein. A glance at the diagrams representing lucerne, cowpeas, and velvet beans will show at once that they are much richer in protein and ash constituents, i.e. substances for muscle and bone formation, than oat-hay. Surely a reasonable deduction from this is that, if horses are getting mealies, and the horse owner has the option of using lucerne or oat-hay to supplement them, he ought to chose lucerne or at least give a mixture of the two. Indeed, the evidence is pretty strong that horses in confinement fed on mealies and oat-hay only are particularly susceptible to bone diseases like osteoporosis.

Passing on to the other dry fodder plants, we find that the feeding value drops suddenly owing to a great decrease in the protein and an increase in the indigestible matter. For ruminants, however, they are not to be despised, but they must be supplemented by other foods rich in protein

and fat if something more than a purely maintenance diet is required. Several correspondents have recently been enquiring about the feeding value of mealie cobs, and some who thought that, if ground up, they might act as a substitute for bran, will be rather disappointed to see their low percentage of protein.

The sudden change from the dry fodders to the watery and succulent foods is rather striking when their composition is shown in diagramatic form. I have thought it advisable to place cow's milk on the list to give an idea of how it compares with other foods. Though it only contains about 13 per cent. of dry matter all of this is of the highest quality and completely digestible. Silage (which may be made from a great many plants besides maize) and mangels are specially useful as food for dairy cows in winter, and if they were grown and produced more extensively they would prove very useful for oxen as well before the spring rains have brought new life to the veld. Even prickly-pear leaves, if the thorns are burned off, are not to be despised when the country is parched and dry, though their feeding value is not great.

The next diagram is designed to show the relative amounts of the two principal bone-forming substances in equal quantities of various foods. Most of them have already been referred to, the most striking thing being the richness in lime of the leguminous fodders and the poverty of grains, especially maize, in this substance.

From a consideration of the foregoing facts, does it not seem probable that the undersized condition of so many of our horses and the difficulty in keeping the quality and size of our stock up to the standard of their imported parents may at least in part be due to the comparative poverty of the veld grass in protein and to the deficiency in protein and lime which characterises what have been up till now the common foodstuffs of the Transvaal? I do not wish to labour the point too much, but from every point of view we care to look at the matter are we not confronted with the great desirability of increasing the area under leguminous crops?

The Botanical Section.

THE MILDEWS OF THE GRAPE VINE.

By I. B. Pole Evans, B.A., B.Sc., F.L.S., Plant Pathologist.

Of the many fungous pests of the grape, two, commonly referred to as "mildew," are especially noteworthy, and as they both occur in South Africa, they will be briefly dealt with here. The two diseases are generally distinguished as the "downy mildew" and "powdery mildew." They will be mentioned in this order.

The Downy Mildew of the Grape.

(*Plasmopara viticola*, Berl. & De Toni.)

The downy mildew is a native of America, and was probably introduced into this country some years ago. Its existence was first placed beyond dispute in January, 1907, when it was found on specimens sent from Grahamstown, Cape Colony, to Pretoria for examination, and, although statements have been made to the effect that it existed in Cape Colony as far back as 1879, no authentic record has been discovered which would appear to support this view.*

At the present time, and so far as is known, this mildew only occurs in South Africa in the Eastern Province of Cape Colony. The fungus may attack all green parts of the vine, and may be recognised by the following characters.

It is most abundant and frequently shows itself first on the leaves, where its presence may be detected by the appearance of light yellow areas on the upper surface. These yellow areas generally increase in size, run into one another, and then soon turn brown (see coloured plate), while the corresponding parts *below* exhibit a white glistening growth (see coloured plate). As these changes take place, the white growth—which contains the germs of the fungus—gradually disappears, the leaf dries up, becomes brittle, and soon falls. Complete defoliation may thus be brought about. If this occurs fairly early in the season the nutrition of the vine may be so interfered with that the berries, even if they are not directly attacked, may be so checked in growth that they fail to reach maturity and then remain hanging to the trees as brown shrivelled bunches.

As soon as the white glistening growth disappears, myriads of resting spores or winter spores are formed within the affected tissues, and it is these spores which fall to the ground with the dead leaves that are responsible for renewing the infection in subsequent years, when conditions favourable for their germination present themselves. These resting spores retain their vitality in the soil for years.

The fungus is a true parasite, that is to say, it absorbs all the nourishment that it requires from the living tissues of the vine to the obvious detriment of the same, and for this reason it is well to

* *Vide* Lindau, G., "Notizbl. K. Bot. Gartens u. Mus., Berlin," No. 5 (1908), No. 42, p. 67.

remember that such a disease as this cannot be cured when once the fungus has established itself in the leaf or elsewhere, as it pervades the internal tissues of the host to such an extent that it is impossible to eradicate it without, at the same time, destroying the invaded tissues. The damage once done cannot be repaired. Therefore, if the interests of a community demand it, it is far better to adopt drastic measures to exclude the pest than to leave a loophole by which it may establish itself in an area where it will always be a continual source of loss and danger to the planter, as it did in France in 1878, where it has, ever since, been a constant source of loss and trouble to all the grape-growing countries of Central and Southern Europe in spite of the combined efforts of the Governments and individuals concerned to eradicate it. When once the fungus appears in a large vineyard, it is always liable to reappear from year to year as conditions are favourable, and the grower is henceforth confronted with costly preventive measures in the form of spraying, etc.

The treatment usually adopted to prevent the spreading and check the ravages of this fungus is that of spraying the vines with the fungicide commonly known as bordeaux mixture. The best formula to adopt for this climate, and especially for spraying young and tender leaves, is:—

Copper sulphate	1 lb.
Best quicklime	1 lb.
Water	100 gallons.

It is important that the best quicklime should be used in order to ensure an excess of lime. In all cases the lime should be first slaked, made into a smooth paste with water, and then poured into the copper sulphate solution. The mixture should be kept constantly stirred and used as soon as it is made up.

Before applying the mixture it should be tested to see that there is no free copper sulphate present. This can easily be done by inserting the blade of a steel knife into the liquid, when no deposit of metallic copper should result, or another simple test is to breathe on a small quantity of the liquid, when a creamy white film should be formed showing the presence of lime in excess.

The mixture here recommended, while being quite efficacious, is not likely to injure the foliage, as frequently results from the use of mixtures of greater strength.

If the disease has once appeared in a vine or vineyard, or is known to be in close proximity to such, it will be advisable to spray at least three or four times during the season in subsequent years, even if no evidence of the fungus is observed. The keynote to success in combating this trouble is to endeavour to prevent the fungus from appearing by judicial spraying, and not to wait until the fungus shows itself before spraying is commenced.

The spraying should be done when the young shoots are about 6 inches long, just before the flowers open, three weeks after flowering, and three weeks later. Much, however, will depend upon the character of the season and the circumstances to which the vines are exposed. If, for instance, the season is an exceptionally wet one, it will probably be necessary to spray at more frequent intervals than those mentioned above, or for other reasons it may be well to increase

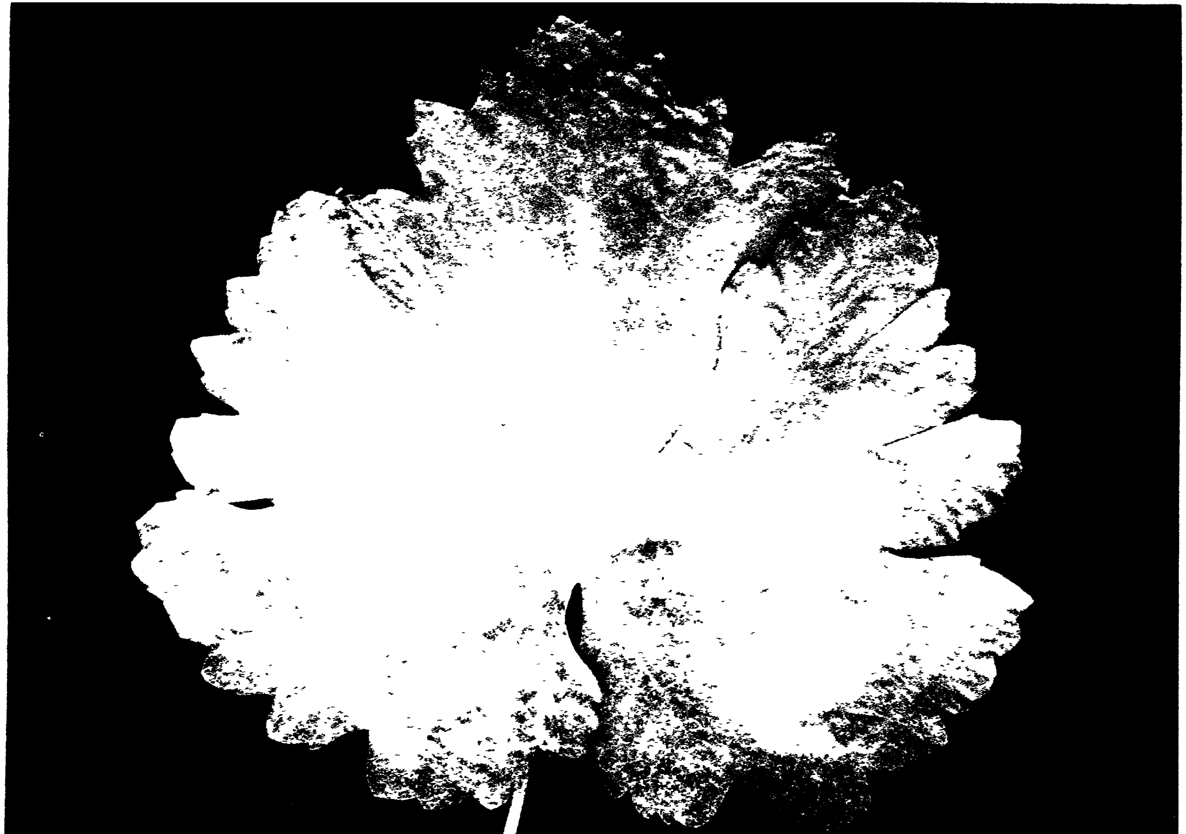


Plate A.

The Powdery Mildew of the Grape.

(*Uncinula spiralis* Berk. and Curt.)

The Downy Mildew of the Grape Vine.

[illegible]

[illegible]

the strength of the spray. Another important consideration with all such fungous pests is that all diseased leaves, fruit, and other material be carefully collected and burnt so as to destroy as many of the resting spores as possible.

It will readily be understood, from what has been said above, that too much attention cannot be given to fungi of this nature, especially if they occur in a vicinity well stocked with the necessary host plants, otherwise dire consequences are sure to follow sooner or later.

The Powdery Mildew of the Grape.

(*Uncinula spiralis*, Berk. & Curt.)

This mildew, like the downy mildew, is also a native of America, although it belongs to a very different class of fungi, and has an entirely distinct habit of growth.

It occurs on vines throughout South Africa, and has been known for years at the Cape simply as "Oidium," a name which it still retains to-day in many of the grape-growing districts of the world.

Before the complete life-history of this fungus was known, the white mildew stage which was first noted, and which attracts most attention to-day was named, botanically, *Oidium tuckeri*, Berk.; hence the origin of the term *Oidium* for this disease. Some years later its resting or winter stage was found, and it was then renamed *Uncinula spiralis*, Berk. & Curt.

The fungus attacks all green parts of the vine, and is generally very troublesome in seasons that suffer from drought.

It is usually most conspicuous on the leaves and berries, where it occurs in dull greyish-white patches as though they had been dusted over with meal. (Plate 31.) On the leaves these patches always appear on the *upper* surface, though, in exceptional cases, when the attack is abnormally severe, the white fungous growth may sometimes spread to the lower surface.

It is readily distinguished from the downy mildew (*Plasmopara viticola*) in that it never has the bright lustrous appearance about it which is so characteristic of the latter fungus, while the brown scorched blotches which accompany the downy mildew are rarely ever present.

The dull white patches gradually extend over the entire leaf, which then curls up towards its upper surface in a very characteristic fashion. In fact, vines attacked with the powdery mildew (*Oidium*), as a rule, present a wilted appearance, whereas those affected with the downy mildew (*Plasmopara viticola*) have a decidedly scorched look about them. The berries may be attacked at all stages of growth. If this happens when they are very small, then they fail to develop and drop off. If it occurs later in the season the parts affected by the fungus become hardened and cease to grow, with the result that a cracking and shrivelling of the berries may result.

The young shoots are often entirely checked in their growth by the action of the fungus, which disfigures them, as they get older, with brown to black fern-like markings.

The powdery mildew, unlike the downy mildew (*Plasmopara viticola*), lives almost entirely upon the surface of its host. It does not penetrate into the interior of the leaf, but gently extracts its

nourishment from the leaf or other parts by means of small absorbing organs which are driven into the leaf from without and which also serve to anchor the fungus to its host. Owing to this fact this mildew readily succumbs to treatment and the fungus can be completely overcome without injury to the vine from the remedy used. The most effective treatment is dusting the vines over with flowers of sulphur.

Finely divided sulphur is much more effective than that of coarse quality, and the best results are obtained by using a good sulphur sprayer. One of the best sprayers is known as the "Vermorel soufreuse Torpille," which is of European manufacture. Other methods of applying the sulphur are simply by throwing it on with the hand, or by means of sulphur bellows, or by enclosing it in linen bags and then dusting it on. Of these three the latter will usually be found the most practical, but they are all wasteful and not so efficacious when compared with the results obtained from a good sprayer. Sulphuring of the vines should always be consistently carried out before any trace of mildew appears, and rigorously renewed on the first symptoms of disease. All vines should be sulphured at least three to four times during the season.

It is impossible, however, to lay down any hard and fast rules as to the number of sulphurings, as much will depend upon local circumstances, such as previous infections, character of the season, locality, and situation of the vines and so forth. One of the most important periods for sulphuring, and one which should never be neglected, is at the time of blossoming, as vines in the Transvaal frequently suffer from a trouble commonly known as "Couloure"—the non-setting of the berries. This defect can be minimised to a great extent by sulphuring during the flowering period. The sulphur, in some manner yet unexplained, exerts a stimulating action upon the setting fruit.

If the vines suffered severely from mildew the previous year, it is well to sulphur about two weeks before the flower buds open, again at the blossoming period, thirdly when the fruit is about the size of buckshot, and perhaps a fourth application just before the fruit begins to ripen.

The best time at which the sulphur should be applied is when the leaves are thoroughly dry, otherwise, if they are wet from rain or dew, the sulphur tends to run together in lumps and is then unevenly distributed over the leaf. An even and uniform distribution of the sulphur on the leaf-surface is most essential for the best results. If rain falls after the sulphuring has been done, the vines must be resulphured.

Towards the end of the season the resting stage of this mildew appears on the leaves in the form of little round black pin-points. These fall to the ground with the leaves, and, after passing the winter in the soil or crevices in the bark of the vine, are responsible for renewing the infection in the following year. The destruction of these spores or the prevention of their formation is consequently of considerable practical importance and should always be aimed at. This can best be accomplished by entirely controlling the mildew by the constant application of sulphur and by carefully removing all diseased leaves and burning them.

Even if the mildew appears after the crop is taken off, it is advisable to sulphur heavily so as to prevent the formation of the winter or resting stage of the fungus. This sulphuring will also have a most beneficial effect on the general health of the vines in the following season, inasmuch as they will be better supplied with reserve material for their new growth than would have been the case if the mildew had not been kept in check.

A NOTE ON THE EUROPEAN APPLE-TREE CANKER FUNGUS.

(*Nectria ditissima*, Tul.)

By I. B. Pole Evans, B.A., B.Sc., F.L.S., Plant Pathologist.

In the previous number (No. 25, p. 62) of this *Journal*, the presence of the New York apple-tree canker or black rot fungus in South Africa was noted. Since then another orchard pest, commonly known as the European apple-tree canker fungus (Nectria ditissima, Tul.), has been met with, which it will be well to briefly mention here.

The fungus (Nectria ditissima) was found in a consignment of 5,000 young apple trees sent to Pretoria from Melbourne, Australia. All the trees were infected, and consequently were promptly destroyed by the Department of Agriculture as soon as the disease was detected. The general appearance of a few of the infected trees is shown in Plate 32.

This canker fungus attacks a large number of trees, such as the alder, apple, ash, beech, bird-cherry, dogwood, hazel, hornbeam, lime, maple, and oak. It is particularly troublesome in countries where trees are liable to injury from hail and sun-scorch, as the parasite readily gains an entrance through such wounds.

Whether this fungus already occurs in South Africa is a matter for further enquiry. Up to the present it has only been noted by the writer in the consignment of apple trees referred to above, and although the fungus is fully described by Professor MacOwan in the *Cape Agricultural Journal* for March, 1894, no mention is therein made as to whether the disease actually existed in the Cape at that time. Mr. Lounsbury, the Cape Government Entomologist, in a recent communication on this subject, says that he is not familiar with the disease in that Colony.

The importation of this fungus from Australia only serves to show how important it is that all plants from oversea and elsewhere should be examined by a competent officer before they are allowed to enter this Colony, and when it is realised that these 5,000 infected apple trees might have been planted in the Transvaal, if they had escaped inspection, it can hardly be wondered at that this country is already so heavily burdened with foreign pests.

PREVENTION OF BLOAT FROM PASTURING LUCERNE.

By Joseph Burtt-Davy, F.L.S., Government Botanist.

Certain cases of loss of cattle by hoven (bloat or opblaas) from pasturing lucerne, while wet with dew or rain, have recently occurred in the Transvaal, and in consequence some farmers have taken alarm and are afraid to pasture their stock on this useful crop. There is practically no danger, however, if proper care is exercised. Throughout the Western States of America, in California, Mexico, and the Argentine, pasturing of cattle on lucerne is carried on to an enormous extent, with a minimum of loss; in fact, it is the only practical method of handling large mobs of stock on large areas of lucerne.

I learn on reliable authority that, for three months of last winter, 1,800 head of sheep were pastured continuously on dry-land lucerne at the farm Leeuwkuil, near Vereeniging, without a single loss during that period. During the first few days, however, when the sheep were first introduced to the lucerne pasturage, and when they were being taken out to dry grass each night, the loss from hoven amounted on an average to two head a day. These losses ceased when the flock was kept continuously in the lucerne paddock.

When animals are only allowed to graze for a short time each day in the lucerne paddock, but driven out after they have had what is considered a sufficient feeding, there is danger of loss unless they are driven *very slowly*. Quick driving seems to hasten the formation of gas in the paunch, or at any rate to have a deleterious effect on the system.

The following practical advice on the subject is given in the Denver (Colorado) *Field and Farm*, and is repeated in the *Pacific Rural Press* (California) of 2nd May, 1908:—

"When first turning cattle or sheep on to lucerne pasture in the spring, especially if they have pastured on it before and have an appetite formed, it is always safest to fill them up pretty well on some grass or hay. When they are once there, keep them on it day and night. More bloat is caused by bringing stock to the kraal in the evening, and keeping them there till late the next morning, than any other way. They go out hungry, gorge themselves, then go and drink a lot of water with annoying, if not fatal, results. Every cattleman should have a trocar while pasturing lucerne, but should never use it unless absolutely necessary.

"Many remedies have been advocated, but paraffin oil is probably the most effective and prompt of action. Keep a can of it and a drenching bottle—a heavy long-necked beer bottle—with the trocar, and also a smooth stick 1½ feet long and about 2 inches in diameter, with a small rope attached to one end of it. When a case of bloat occurs, bring the cow to the kraal or stable and give half a teacupful of paraffin oil with the same amount of water, if handy; but if not, and the case is a bad one, give it straight, as it will do no harm. A cow is easily drenched. Standing at the right of her neck, with the left hand grasp the nostrils and, elevating the head slightly, insert the bottle into the mouth with the right hand and empty it, as fast as the animal can swallow readily.

Plate 32 **Apple Tree Canker.**

(*Nectria ditissima*, Tul.)

"Place the smooth stick in her mouth and secure it by looping the rope about the horns, then tying it at the other end of the stick. Ordinarily the gas will be belched up, and the animal entirely relieved in a few minutes. If not, repeat in half an hour. Should it fail to give relief, and the animal staggers and seems like falling, use the trocar at once. The proper place to apply it is in front of, and a little below, the left hip, and is not easily mistaken. At this point there is very little flesh, and the paunch is attached to the skin, and in a severe case of bloat it will stand up quite prominently.

"If it is a simple case of gas in the paunch, it will escape very readily through the canula, which should be withdrawn until the normal condition is reached, which will only be a few minutes. If the gas escapes slowly, and the canula keeps clogging with the contents of the paunch, it is a case of impaction. If no veterinarian is in reach, make an incision large enough to admit the hand and take out the contents of the paunch—not a hatful or two, but a few tubfuls. Then take a few stitches in the paunch and also in the skin, using an antiseptic wash and also internal treatment to keep down inflammation. If done at once, the cow has a chance. If neglected until fever sets in, she has none."

RAMIE CULTIVATION.

By Joseph Burtt-Davy, F.L.S., Government Botanist.

Correspondence continues to appear from time to time in the daily papers urging the cultivation of ramie (*Boehmeria nivea*) in South Africa.

The Department of Agriculture has demonstrated that ramie can be grown even on the high veld of the Transvaal, although the yield is not as great as in more tropical climates.

But it is not sufficient to be able simply to grow a fibre crop; its success as a commercial enterprise will depend on economical and profitable handling. The great difficulty with ramie has been that, up to the present, no machinery for the economical decortication of the fibre has been invented which would entirely meet the needs of the industry, and turn out a sufficient quantity per diem of "ribbons" of good quality to keep the cost of production within reasonable limits.

It is true that a small machine, for experimental purposes, is being manufactured in England and sent out to the Colonies, but we are informed that this is defective in certain points, and that on plantations it is not found to be of practical value. It has been tested in Natal with very disappointing results. As it is desirable that Transvaal farmers who are interested in the subject should have the fullest available information, the following extract from the *Kew Bulletin of Miscellaneous Information*, 1907, pp. 4 to 8, will probably be of service.

I would call the special attention of readers to the following facts, which have been demonstrated by the experiment referred to:—

(*a*) A ramie field must be well cultivated.

(*b*) The field must be cleaned by hand labour to avoid damage to the roots and young shoots. In view of the

expense and inefficiency of the agricultural labour available in this Colony, these two points are worth careful consideration.

(*c*) Ramie is a very exhausting crop requiring manure; unmanured plants yield a very poor crop. It is well known that the average quality of the soils of the Transvaal is poor, as compared with that of many other countries. Moreover, stable and kraal manures are not easily obtained, and chemical manures are exceedingly expensive.

(*d*) To yield a paying crop, ramie is said to require a humid climate, with a rainfall of at least 45 inches per annum. In India, two plantations had to be abandoned where the annual rainfall did not exceed 35 inches. The area of the Transvaal in which the rainfall meets this requirement is so extremely limited and its topographical and other conditions are such that it does not seem likely that ramie cultivation will ever be an important industry there.

These facts speak for themselves.

In the *Agricultural Ledger*, 1898, No. 15, pp. 37-46, Sir G. Watt, in dealing with the cultivation of rhea or ramie in Bengal, indicated the extent to which it was then actually grown in that province. He remarked particularly the suitability of the plant to the north-eastern districts of Rungpur, Jalpaiguti, and the Duars, and indicated the possibility of an extension of its cultivation westward to Tirhut, though, at the same time, he pointed out that how far this extension was really possible was for the future to show.

Considerable interest, therefore, attached to the experience of an association formed in Calcutta in 1900 for the purpose of putting on the market ramie fibre in a commercial form. This association, the Bengal Rhea Syndicate, entered into an agreement with various planters in the District of Durbangah, in Tirhut, under which the growers were to put a definite area under ramie and provide rhea stalks, the syndicate supplying the necessary machines to produce from these the commercial fibre. It has long been known that there is no serious difficulty attending the cultivation of ramie, provided the soil is suitable and the climatic conditions are at all favourable. As has already been pointed out (*Kew Bulletin*, 1888, p. 298), the chief difficulty is as regards the decortication of the ramie stalks. The experience in Tirhut is, therefore, of further interest as throwing light on such practical advances as may have been made in this direction.

That the plant could be successfully grown in Tirhut on an experimental scale was already known. Various planters in Tirhut had demonstrated this in plots containing plants raised from roots supplied from the Royal Botanic Garden at Calcutta, and to a smaller extent from the Botanic Garden at Saharanpur. But what Sir G. Watt had in view, and what it was desirable to test, was whether—if the difficulties attending decortication were overcome—the cultivation of the plant in Tirhut was likely to prove remunerative commercially. The original contracts entered into by the syndicate in question were nine in number: the area involved amounted to 3,700 acres. Actually, however, owing to difficulties connected with soil and rainfall, operations had to be restricted to seven concerns, with an aggregate area of [illegible],100 acres; and, of the suitable available land, the

amount actually under ramie in February, 1906, was 1,950 acres. The results of these operations, which have now extended over several years, are calculated to throw some light on both questions.

These results have been made generally available by the publication in the *Journale d'Agriculture Tropicale* for 30th June, 1906, of the French text of an account of the operations, which is there stated to have been supplied on 10th February, 1906, to the Director of Agriculture, Bengal, by Mr. J. Karpelés, the managing director of the Bengal Rhea Syndicate. The original agreement entered into by the syndicate with the planters in Durbangah stipulated that the growers were to produce the ramie stalks, while the syndicate were to supply the machines for preparing the commercial fibre. The fact that the firm in Calcutta, to which the syndicate's managing director belongs, acted as agents in India for the machine especially devised by Mr. Faure for dealing with ramie, adds further to the interest of the account.

In the *Queensland Agricultural Journal* for November, 1906, p. 247, is given a translation of the report referred to, which is here reprinted. Its value is considerable, owing to the fairness with which the results obtained and the difficulties encountered by the Bengal Rhea Syndicate have been stated. But, as pointed out in the *Queensland Agricultural Journal*, it possesses another interest—it gives for the first time, so far at least as India is concerned, an account of operations on a scale sufficiently extensive to justify the formation of reliable estimates for a plantation:—

"At the outset there was considerable difficulty in procuring the necessary quantity of plants to establish the plantations. Some small lots of stocks (rooted plants) were certainly obtained from various localities, notably from Assam, and from sundry Indian botanical gardens, but these supplies were insufficient in quantity, and often of bad quality; it therefore became necessary to establish on each farm a nursery for the multiplication of rhizomes.

"The plantations suffered much from the attacks of white ants, which rapidly destroyed the young roots, and especially the cuttings. The planting of cuttings, however, during the rainy season obviated to some extent this inconvenience, but still the best method of reproduction is the division of the rooted plants. Portions of the rhizomes may be taken from one to two-year-old plants without injuring them.

"It was evident from the commencement that successful plantations could only be established on light, porous soils; saltpetre and brak soils are not conducive to the successful production of ramie. On well-cultivated lands, where noxious weeds had been carefully eradicated, every root produced annually fifteen to thirty stalks, about 5 feet in length, whilst in a field left as an experiment, without cultivation, produced only from two to five stems per plant: the plot in the same field, called the 'control plot,' which had been weeded and cleaned, gave ten to fifteen stems. It will thus be seen that a ramie field must be well cultivated, in spite of the increased expense, the field having to be cleaned by hand labour to avoid damage to the roots and young shoots.

"In the three-year-old well-cultivated fields, no sign of soil exhaustion has yet been observed, although the upper part of the root

has a tendency to become woody, to the detriment of the development of new stems. To overcome this, it is intended to remove the lignified portion every year in order to rejuvenate the plants. Experience alone will decide if this is a good idea.

"Ramie is a very exhausting crop, and, therefore, the question of manure must be carefully studied, for unmanured plants yield a very poor crop. Good results were obtained by the use of indigo refuse. It is said that the refuse of ramie itself, such as the leaves, bark, and wood, constitutes a perfect manure, sufficient to restore to the soil the constituents taken out of it by the crop. But up to the present no experiments in this direction have been possible, as nowhere has the decortication of the stems been carried on in a systematic manner. However, at Dalsing Serai, a manure consisting of decomposed ramie refuse was applied to the experimental plots with excellent results. It has not yet been determined what quantity of such manure is needed. At Dalsing Serai and Mooktapore, where respectively sixty and forty acres are in full bearing, there is a sufficiency of fermented material which will be utilised for manure. The leaves, separated from the stems when the latter are cut, are left on the ground, and these form a good mulch for the roots, at the same time supplying a manure.

"Ramie requires a good deal of moisture to properly develop, but water must not be allowed to remain too long on the ground, as the rotting of the roots would probably be thus caused. This was the unfortunate experience on plantations established on the low, flat country, where last September (1905) many hundreds of acres were destroyed in consequence of the heavy rains. Ramie requires at least 45 inches of rain per annum. Two plantations had to be abandoned where the annual rainfall did not exceed 35 inches. Consequently, cultivation was only carried on on seven plantations, representing an aggregate area of 3,100 acres, of which 1,950 acres were planted up to February, 1906. The remaining 1,150 acres will, we are told, be planted during the next rainy season.

"It is very important to cut the stems at the proper time. If they are cut too soon, they yield a very fine fibre, but in small quantity; if cut too late, the decortication becomes more difficult and the fibre is brittle. The best time to cut is when the base of the stem is of a brownish tint for a height of about 10 inches. The stems must be worked up immediately they are cut. The decortication is much more readily performed if carried out within twelve hours of the cutting. When they have been allowed to dry, decortication is more difficult, and the fibre is inferior. If circumstances render it necessary to defer decortication, the stems, having the leaves removed, are made into little bundles of thirty or forty and preserved in water, where they will remain unchanged for forty-eight hours.

"Fibre containing 30 per cent. of gum does not easily dry in the climate of Bengal. The syndicate has, therefore, been obliged to have special drying apparatus constructed in Paris, and installed on each plantation. The fibre, on leaving the decorticating machine, passes first through a centrifugal drier, made by Dehaitre, which removes 70 per cent. of the water it holds. It is then hung up in a large closed-in straining room, supplied with a current of warm air set

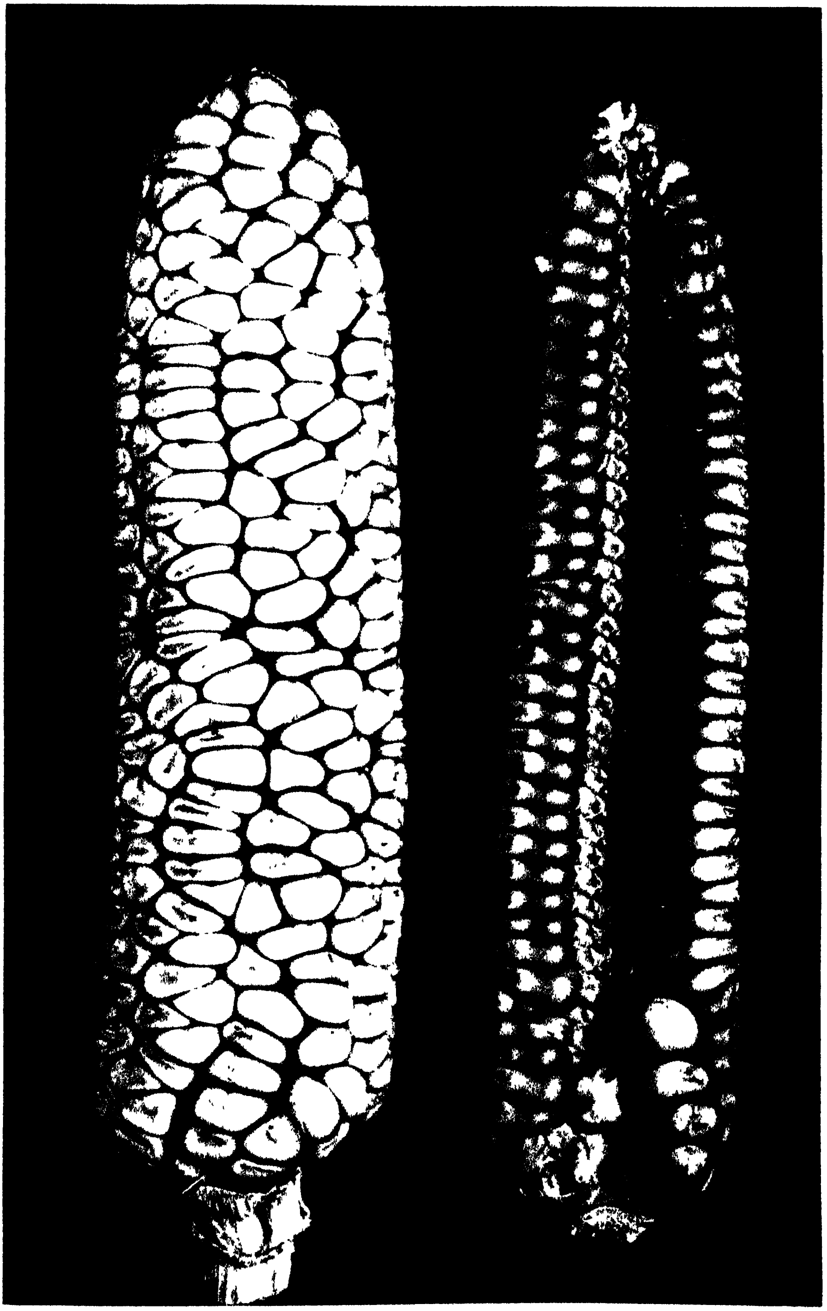


Plate 33. Fig. 1. Fig. 2.

Poor Types of Maize (Mealies).

Fig. 1. Too irregular. Fig. 2. Too open.

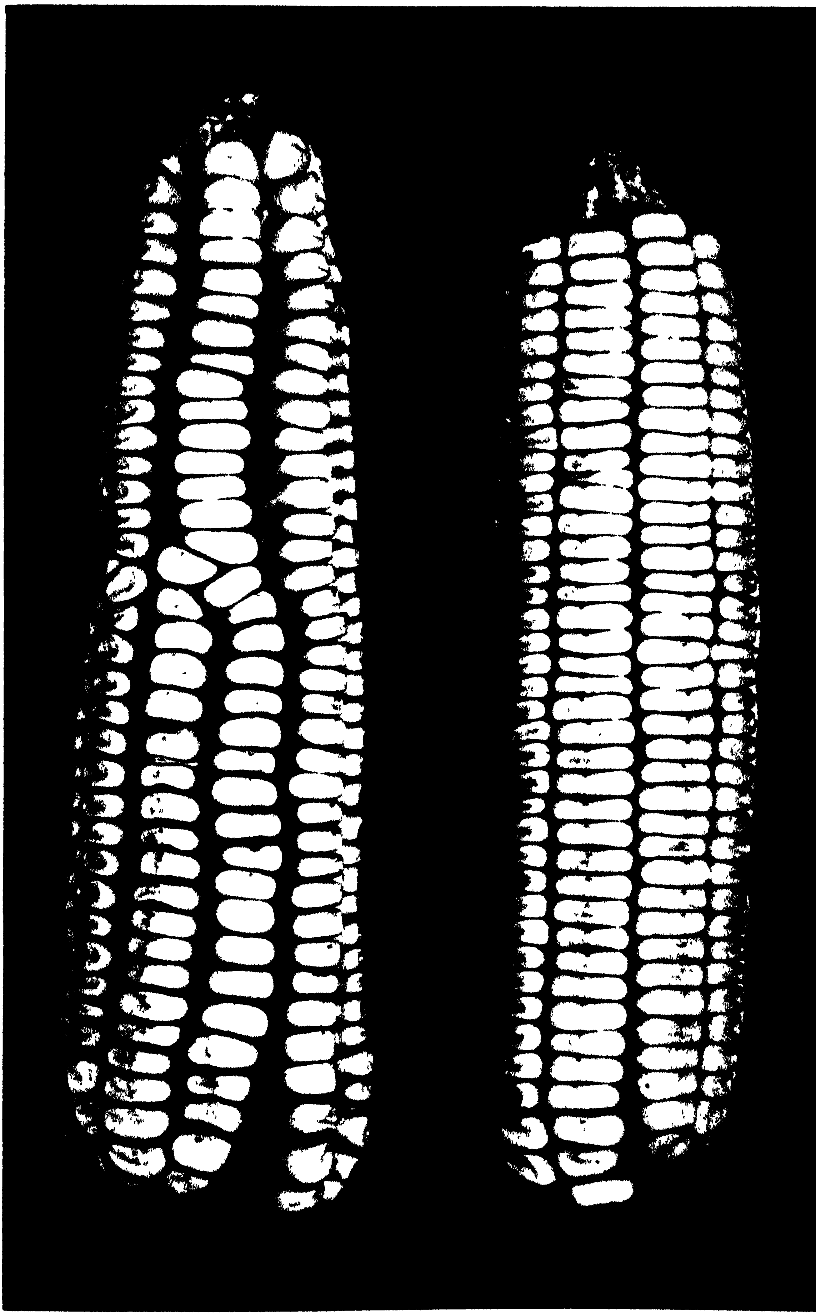


Plate 31. Fig 1. Fig. 2

Ears of Maize (Mealies).

Fig. 1. Too loose and irregular Fig 2. A good, well-formed ear.

in motion by a fan. The fibre, when ready, must be at once baled, for it readily absorbs a quantity of fresh moisture from the air, which would soon produce fermentation and mouldiness. At Dalsing Serai a hand-press is used. A 20 h.p. engine is sufficient to drive all the machines required for 500 acres. As the fibre has to be washed as it passes through the decorticators, a good and sufficient water supply is indispensable. The fibre must not be twisted, as this imparts to it a permanent undulation which depreciates it from the spinner's point of view. Many samples of ramie fibre produced by the syndicate were sent to Europe to several spinners. They were considered quite equal in quality to China grass, and very shortly orders were received totalling 1,500 tons. Some 20 tons of better quality fibre, more carefully prepared than hitherto, have been lately exported from the syndicate's estates.

"From a forecast of the next year's crop (1906), the syndicate should be in a position to deliver at least 200 tons of fibre from the 1,950 acres already under cultivation. This is said to be a very moderate estimate, since the normal production from this area will be (it is estimated) 800 tons when in full maturity.

"It is the intention of the syndicate in the near future to degum the fibre as well as decorticate the stems, in order to save the freight charges on 30 per cent. of gummy substance contained in it. But as every spinner of ramie has his own particular method of degumming, all of them require the fibre to be delivered to them without its having been subjected to any chemical treatment. It is hoped, however, that flax spinners will some day take up ramie as well, and will accept the fibre degummed on the plantation."

In connection with this account of the operations of the Bengal Rhea Syndicate, the *Queensland Agricultural Journal* publishes certain critical remarks on the prospects of successful cultivation of ramie in Queensland. But Queensland is not the only Colony where there are considerable areas with climatic conditions approximating to those that are known to prevail in Tirhut, and the questions raised in the *Journal* deserve consideration by those who contemplate the extensive cultivation of ramie elsewhere. These remarks are, therefore, produced below.

"From the above account of the operations of the Bengal Syndicate, we can form some idea of the initial difficulties to be encountered in entering upon ramie cultivation. After six years' work the company has 1,950 acres under cultivation, from which they have obtained twenty tons of fibre, and possibly 200 tons will be the result of the 1906 crop. Two hundred and twenty tons is not a large return from such an area. The expenditure on over 3,000 acres must have been very considerable during six years. With cheap and abundant and reliable labour, the necessary humid climate, and abundant water supply, and cheap water carriage, one would have expected far greater results. Ribbons are worth £14 per ton in the English market. Clean, degummed fibre is worth £50 per ton. Clean, undegummed fibre from the plantation is worth about £24 per ton in London. At this latter price, 220 tons would be worth £5,280, or a return of £880 per annum spread over the six years since commencement. Decorticating machines, motive power, expenses of management, labour, freights, etc., have all to be deducted.

"Mr. J. Macdonald (of Macdonald, Boyle & Co., London) estimated the cost of 900 acres of ramie under cultivation, from planting to extraction of the fibre, at £6,477 17s., and the machinery at £6,775. At the end of the first year the product might be estimated at 450 tons of clean fibre, ready for the manufacturer. This, at 4½d. per lb., amounts to £18,900. Deducting the cost of production as above, also £900 for freight, and £260 for brokerage and incidentals, a working profit remains of £11,262 3s. This estimate, so extremely sanguine, was based on a three and a half to four-years-old ramie plantation. Yet Mr. Macdonald begins operations six months after planting! An obvious discrepancy. Practical men would be better pleased to see a well-considered, moderate statement work out a possible profit of £5 per acre than to be met with £12 profit per acre the first year, and well-nigh £50 in the second, from a cultivation which, so far as we know, no one has yet tried, except the Bengal syndicate above described, on a scale sufficiently large to justify reliable estimates for a plantation, at any rate in the Eastern world. Queensland planters would not be likely to drop sugar, cotton, pineapples, etc., for a return of £880 per annum from 1,950 acres, and from which return heavy expenses have to be deducted."

COTTON CULTIVATION.

The Importance of Seed Selection.

By Walter S. Charter (Acting Manager, Government Estate, Tzaneen) and H. Godfrey Mundy, P.A.S.I. (Assistant for Field Experiments).

With cotton, more, perhaps, than with most crops, selection of the seed plays a most important part, and the cotton planter of to-day, if he is to obtain the best price for his "lint," cannot afford to plant any seed which comes promiscuously from the "ginnery." In the first place, it is essential that our cotton crops should be pure, that is to say, unmixed. If two or three different varieties are grown together in the same field, not only is deterioration likely to occur, but the crop will lose that uniformity of character which is to be expected from pure stands. With cotton as with wool, uniformity of quality (length of staple, strength, and lustre) is of the utmost importance. This point was forcibly brought home to us last year, when certain bales of "mixed" cotton were despatched to the Liverpool market. This cotton was not only adversely criticised by the buyers, but further failed to command anything like the price per lb. which "unmixed" Transvaal cotton had previously done.

When a large number of different varieties are grown in the same district, and all are sent to the same factory to be ginned, it is often difficult to obtain pure seed from the ginnery: and even where this is possible, such seed is likely to be of inferior quality, and to cause deterioration of the subsequent crops raised from it. The requirements of the market must be studied, and, at the same time, due regard must be paid to the conditions of soil and climate which obtain

in the district where the crop is to be grown. Having determined which variety is the best suited to our particular conditions, we should then practise some method of seed selection so as not only to maintain the quality of the crop, but to improve upon it.

With us in the Transvaal, American upland varieties have so far proved the most satisfactory, but there are many different strains of American upland cotton, and each one differs from the other in some more or less important characteristic. The following are some of those which have given the best results:—Allen's Silk Long Staple, Cook's Silk Long Staple, Russell's Big Boll, Black Rattler, King's Improved, Bohemian, Hawkin's Improved, Upland Big Boll, Excelsior.

The fundamental principles of seed selection have already been determined, and it is only necessary for the Transvaal cotton planter to adapt these to meet his own requirements. Time and again it has been proved that selected seed gives a better and more uniform crop than unselected seed; and the following table, showing the results of trials carried out last season at the Tzaneen Estate, further demonstrates this point:—

Variety	Yield of Lint from Selected Seed	Yield of Lint from Unselected Seed.
Cook's Long Staple ...	242 lbs. per acre.	120 lbs. per acre.
Upland Big Boll	248 ,, ,,	165 ,, ,,
Excelsior	217 ,, ,,	71 ,, ,,

Any method which will enable a farmer to secure a greater yield of crop from a given area of ground must always commend itself, more particularly when this does not entail increased expense in labour or cultivation. A little care and attention at the time when the first crop of bolls is opening can achieve these results.

Hereditary characteristics are frequently as pronounced in the vegetable world as they are in the animal kingdom, and the plant which shows the greatest number of desirable characteristics, under identical conditions to the rest of the crop, is likely to transmit these qualities to its offspring, and should, therefore, be made use of to the fullest extent. Certain characteristics of the cotton plant are unquestionably hereditary, and, when favourable traits are observed, it should be the aim of the grower to perpetuate these.

The following are some of the most important characteristics which may be looked for in individual cotton plants, and which should be taken advantage of when selecting seed:—

(*a*) Increased yield of lint per plant and, therefore, per acre.
(*b*) Earliness of maturity in conjunction with good yield.
(*c*) Uniformity of length of staple.
(*d*) Increased length of staple.
(*e*) Strength of fibre, lustre, etc.
(*f*) Resistance against disease and against drought.

If the cotton hitherto grown has been deficient in length of staple, the grower should turn his attention towards remedying this defect by selecting and planting seed from those plants showing the greatest length of staple, and, again, if the yield of lint is light, heavy-yielding plants should be selected as parents.

It is best to deal with one defect at a time, and not to attempt too many improvements at once. Let the grower decide which characteristic he most needs to improve, and let him for the time being go for this one only; when this defect has been remedied he can turn his attention to improvement in other directions with the selected plants he has already obtained. Each succeeding improvement should be made on the stock which has already been improved.

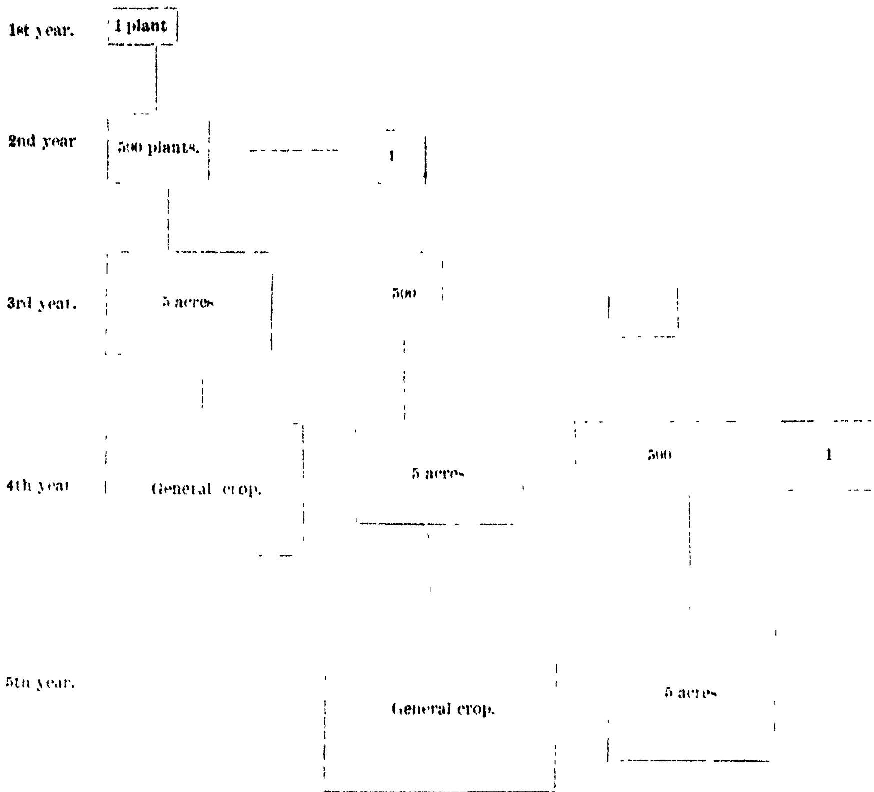
For a beginning it is desirable to select from the field-crop those plants most nearly approaching the desirable type which one has in mind, and from these—which should be of as uniform a nature as possible—select about 100 of the best bolls, and from those bolls which give a good sound fibre of uniform length and strength select the seed for the coming season's further trials. The 100 picked bolls from selected plants should give sufficient seed to sow at least a quarter of an acre, and from this area some 300 lbs. of seed cotton should be raised. Suppose in the second year's selection only one-third of this amount is retained for selected seed, we shall still have somewhere about 60 to 70 lbs. of good quality seed saved from the very best plants we have been able to raise, or, in other words, sufficient to plant an "increase plot" of from six to ten acres the following season. From this area the grower will not only raise enough seed for his own use, but should be in a position to supply selected seed to his less painstaking neighbours.

An important point in the raising of selected seed is that the "increase plots" should be regularly inspected, and any plants which appear unthrifty, or otherwise fail to come up to standard, should be ruthlessly pulled up. The soil on which the selected seed is raised should correspond with that of the ordinary field-crops as nearly as possible, and the "increase plots" should be carefully tended and should be cultivated whenever necessary in order to encourage a healthy and vigorous growth. A record should be kept of the particular characteristics on account of which certain plants were originally selected, and any of the subsequent progeny which do not conform to this type should be discarded, only those plants which have the power of transmitting the desirable parental qualities being retained.

Simple seed selection with cotton is not the slow process of improvement which some may imagine it to be; in almost every field of cotton, certain plants stand out prominently as heavy yielders, while others in the same field under similar conditions of soil, climate, and cultivation, are poor specimens and small yielders. If seed is selected from the heavy yielding plants, the results, even in the first year, should justify the little extra trouble entailed.

Under no circumstances should seed which is obtained from the ginning of the ordinary field-crop be used again the following year, but only seed from superior plants, and great care should be exercised that such selected seed does not become mixed with inferior seed at the ginnery.

The following plan for breeding cotton is suggested by Dr. Webber, of the United States Department of Agriculture, and shows the simplicity with which the work can be carried out:—



In this way, in the fourth year, and then in every succeeding year, the selected seed from five acres is used for the entire planting of the general crop, and this seed has been derived from an individual typical plant by which the desirable characteristics have been faithfully transmitted. It will also be noticed that each year one is building up and improving a strain which has already been improved upon, and that, at least in theory, there is no limit to the improvement which it may be possible to achieve.

The Horticultural Section.

MANDARINS, TANGERINES, OR NAARTJES?

By R. A. Davis, Government Horticulturist.

With the initial efforts, experiments one might call them, in the export of citrus fruits from the shores of South Africa to England, the vocabulary of the old country has been enriched with yet another strange word, "Naartje." Possibly not one in every hundred thousand knew what to expect when it appeared in the newspapers that "naartjes" were being landed from South Africa. It is to be hoped, more, it is to be expected, that in the course of a few years the word, or its equivalent, will be almost as familiar in large English towns as it is in the Transvaal, and that householders will be on the alert to make sure of getting the particular brand they fancy. As to the word itself, for good or for evil, it has already largely obliterated the more euphonious "mandarin" and "tangerine," as far as South Africa is concerned. The writer was as much puzzled as anyone could be when he first heard of "naartjes" in Cape Colony, now over ten years ago, and on being shown a tree in a friend's orchard, exclaimed at once, "Why, that is a mandarin." He was solemnly assured that he was mistaken. The tree was a naartje tree, that and no less, and naartje it has remained.

Everyone in South Africa knows what a naartje is; there are all kinds, large and small, flat and round, tight skin and loose skin, skins that colour to a rich deep red, skins that are clear orange, and as clear yellow, and skins which are still green when the fruit has long been ripe. They are all "naartjes." No ordinary orange possesses the aristocratic breeding of this fruit, botanically "citrus nobilis." Can it not be eaten by a lady without removing her gloves or soiling them either? That is why in Florida, United States America, it got the name of the "kid glove orange," for it is of the orange family after all. They do not know anything about naartjes in the United States of America, not yet, but they will, for the Department at Washington, which has agents hunting for good things the world over, has already asked for cuttings for grafting purposes, and some have been sent, and more are on the way. Afterwards, when the cutting has become a tree, and has borne a few sample fruits, our friends across the water will say, "Why, this is a mandarin." Fortunately they have been warned in time, so that they will not feel that a fraud has been perpetrated on them. They will doubtless wonder where the word came from: it is not English, it is not Dutch, most likely has a Malay origin, and has been assimilated into the "Taal," as indeed have many other words of a like importation. If that is so, it is highly probable that quite without being aware of it, we have gone back to the original name of this fruit, or something very much like it, for the "naartje" first came into the pages of history from Southern China and the Malay Peninsula.

It certainly found its way to South Africa from that quarter, as well as being introduced from St. Helena by the Dutch East India Company. Possibly a larger number of varieties came to Natal than to Cape Colony,

but that was at a later date, and in the meantime two particular kinds prospered exceedingly in the climate and soil of the old Colony. They are there to-day, probably a little better in size and flavour than when they first arrived. The chief characteristics are undoubtedly the same, and this has been maintained by planting layers and seeds and seeds and layers, little recourse being had to grafting and budding. For these two kinds the Platskil, strictly a tangerine, and the Groenskil, which is a mandarin, come true from seed, and will do so until closer planting with other varieties produces cross fertilisation, and the enterprising horticulturist gets an idea that he can improve them by grafting and budding, then seeds will no longer give trees true to their mother type, which in these cases is good and worthy of being preserved.

When this Department commenced experimental work in the citrus line, mandarins and tangerines were imported from Florida, California, Australia, the East, the Mediterranean, and any odd place where report held that extra good kinds were to be had.

Some of these have done exceedingly well at the Experimental Station at Warmbaths, but the Assistant Horticulturist there states that in the eyes of the public these trees are all "naartjes"—and of course they are.

So in South Africa at least the word "naartje" stands for all possible sorts of mandarins and tangerines. It may be of interest to inquire a little as to the difference, if any, between the two latter fruits, their names, and how they came by them.

The mandarin, as its name indicates, is as much at home in China as in Malaya, and it is stated that the name was given because the fruit was of such excellence as to be "fit for a mandarin." Others say that the mandarins in China were the only privileged few who could obtain the fruit because of its high price, and on that account it became known as the fruit of the "mandarins"; anyway it is not of any real consequence.

The tangerine as generally known to the British and European public is a pretty little fruit, which finds its way from North Africa to the large cities about Christmas time annually. It generally comes in nice boxes containing but one layer of the fruit, each specimen being wrapped in gold or silvered paper. Its name is derived from the port whence originally came a large part of the supply, and where the fruit is fairly plentiful. However, it has not been there a very long time, as its home originally was China also. The accepted pomological difference between the mandarin and tangerine is principally that the former is supposed to be a larger fruit than the latter, having usually a nipple at the stem end as opposed to a smaller fruit with a flat base from which the stem has been cut, as shown in the illustration.

The difference is so slight and the crosses so multitudinous that in many cases it would be quite impossible to discover any fundamental difference. It is quite possible in many instances in the Transvaal to pick two fruits from the same tree, one of which shall bear all the characteristics of the mandarin and the other those of the tangerine. This seems a remarkable statement, but the writer suggests that doubtful readers make a little personal investigation next season.

Notwithstanding the above, there are many districts, and that in widely separated parts of the world, where mandarins and tangerines are grown and called by their separate names, each with its recognised type. For instance, take Dancy's tangerine with its rich deep red colour, close-fitting skin, and handsome appearance. How can one class such a fruit

as this with what is known as the Bombay mandarin in South Africa, with its large, loose, puffy skin, containing air enough to enable it to float half out of the water.

On the other hand, there are mandarins of a very high order of excellence. There is no definite line of demarcation between the two fruits, and for general purposes they may be classed under the one South African nomenclature, "naartje."

As giving some glimpse as to the ideas held in England about these fruits, a clause in a recent official letter from the steamship company, which has carried most of the export, to its local agent may be quoted (permission has been asked): "Mandarins—a consignment of these, etc.—this fruit is a cross between the naartje and the orange."

During the past season, in addition to the Transvaal, both Natal and Cape Colony exported "naartjes" to England, the mandarins mentioned above being one of the few parcels consigned under that name. The question naturally now arises, are we to continue shipping naartjes, or mandarins, or tangerines?

In view of possible unification at an early or later date, it appears to the writer that some agreement should be entered into with the other Colonies as to shipping under one name from all.

It would appear ridiculous for each Colony to adopt a different name for the same fruits. Shall we delete the word "naartje" entirely and ship mandarins and tangerines, when the difference between some classes of these is almost imperceptible, or shall we class all varieties of these fruits as naartjes, and quote the particular variety to which it may belong?

FRUIT DRYING.

By R. A. Davis, Government Horticulturist.

The preservation of many kinds of food by means of drying is a practice which dates back from time immemorial.

It has been proved especially useful in the case of many kinds of fruits, such as dates, figs, currants, and raisins, the first two fruits named were those which originally presented themselves as being most suitable for drying purposes, indeed the date in some parts of Northern Africa is regarded as a source of national or rather tribal wealth. The same may be said of the fig in Asia Minor, where the packing of the dried product for world-wide export and the handling of the crop provides employment for thousands.

Currants and raisins also have, from a more recent period, proved a source of revenue and wealth to the producers, besides adding materially to our list of food-stuffs.

Our interest in all the abovenamed fruits is, however, just now, not of the most absorbing kind, because, whilst possibly in the future all these may be grown and dried successfully in the Transvaal, at the present time the most pressing question is how best to preserve such surplus as we may have of peaches and apricots, quinces, etc.

Until comparatively recent years such fruit as was dried was submitted to the direct rays of the sun for a sufficient time to effect the process, and

Plate 36. **Fruit-Drying at Wellington, Cape Colony.**

Outline Sketch of:

Tangerines.

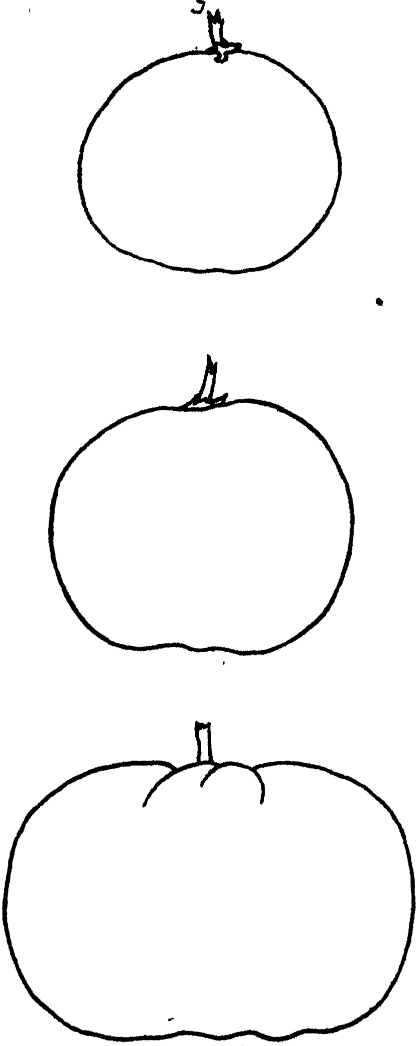


Fig 1

Mandarins.

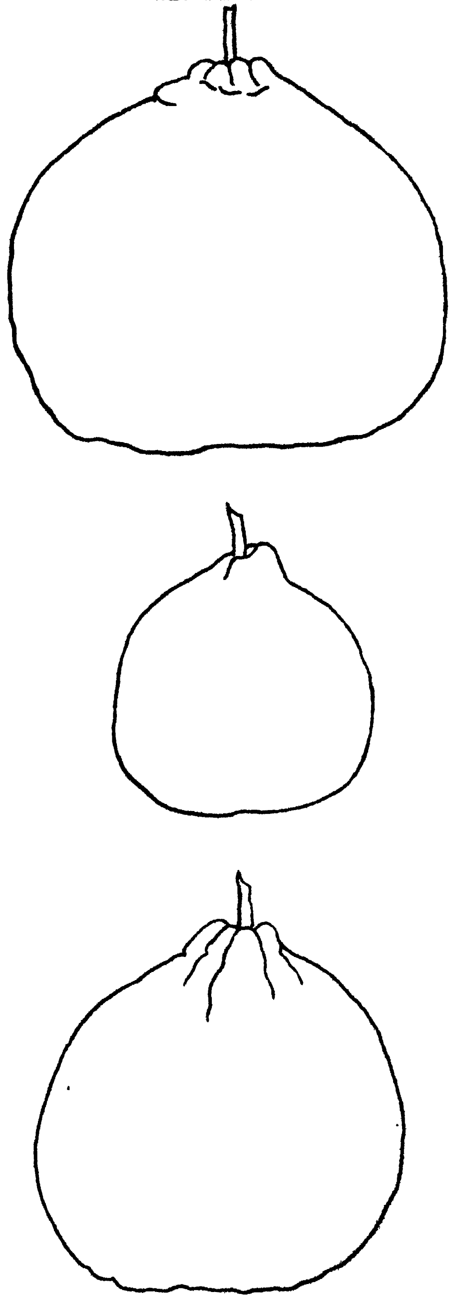


Fig 2.

Plate 37 a.

in the rainless portions of Northern Africa, Asia, and California this was a delightfully easy and simple matter. As, however, the planting of a large acreage of fruit trees extended into countries where climatic conditions were not as favourable as in those mentioned, it was found necessary to adopt artificial methods of drying fruit, and so the machine known now as an "Evaporator" was evolved.

We all know that our climate is unreliable in the summer months, so that if we are to become a dried fruit producing colony we shall of necessity be compelled to have recourse to this machine.

However, there are times when a short spell of dry hot weather would render sun-drying possible, so the ordinary process of drying under such conditions will be described. It must be quite understood that the writer is not here alluding to the production of the home-made article, which is frequently quite good, but rather to such an enterprise as might be possible if an individual in a district or a fruit-growers association should determine to go in for drying fruit as an industry.

Sun-Drying of Apricots and Peaches.

In order to procure the best results, all fruit must be picked from the trees (not shaken) when in a ripe condition. Ripe, but not over-ripe. Half-ripe fruit does not dry well owing to a sufficiency of sugar not having developed, and the green portion of the fruit when dry assumes a dark, uninviting appearance. It must not be shaken, as all bruises dry black, thus producing an unsaleable article. It is best to pick into boxes holding about 40 lbs. of fruit, and having cleated ends, so that a pile of boxes may stand one on the other without injuring the contents, thus the bottom of one box protects the fruit in the one underneath it, and only the contents of the top box are exposed.

Boxes when filled should be hauled to the pitting table, which may be in the shade of some convenient trees. For pitting it is best to employ boys and girls from 12 years upwards. I mean whites, of course, as fruit intended for sale and which has to undergo any manipulation should never be handled by natives. They are slow, unreliable, and not clean. In the case of clingstone peaches, a special knife may be purchased, which renders pitting these a simple and quick operation, and for all kinds of fruit one may now obtain knives made specially for pitting purposes.

Operators and knives being ready, trays for spreading the fruit on, after being cut, are necessary, and here we are in some difficulty. In California and Australia, where fruit-drying is done on a large scale, trays are made of wood, and each measures 3 by 6 ft. Here one is at a loss what to use, so it is suggested that zinc netting half-inch mesh be nailed over wooden frames of the size named, or any other size which may be preferred. A tray 3 by 6 needs two people to handle it, while one 3 by 3 may be conveniently moved about by one man. Mats of reeds or kaffir mats might also be made to serve the purpose of trays, or one could import wooden trays at a cost of about 2s. each.

Trays being ready, the operators commence to pit the fruit and to spread it out over the trays as closely together as possible without crowding, and taking care that each fruit is cut down the centre in exact halves, and that the halves are entirely divided. There must be no skin left to join the pieces together. There must be a complete severance of the two pieces; if this is not done sorting after drying is materially interfered with.

When a sufficient number of trays are full of fruit, they must be placed in an air-tight box and exposed to the fumes of sulphur for a short time. About forty minutes is enough. A sulphur box, as it is called, is easy to make, and should just fit the trays. It may contain slats each side on which to slide the trays in and out, or it may, if the operations are on a large scale, be provided with a trolley and rails on which to run the trays. In any case, it must be as air-tight as possible. Ordinary tongued and grooved timber lined with paper makes a good box.

The sulphur should be placed in a vessel in the centre of the box, and lighted, trays put in, door closed securely, and the fruit left for forty minutes, more or less. The quantity of sulphur to be used depends, of course, on the size of the box, but it may be taken for granted that ½ lb. is a sufficient quantity for 300 square feet, and quantities arranged on that basis.

The object to be attained in this "sulphuring" process is the fixing of the colour of the fruit. It is a common and mistaken idea that fruit subjected to this process is bleached. This is not the case, but after it has been undergone, fruit so treated retains its natural colour for a much longer period than can be attained in any other way. Also, any insects present are destroyed, and the fruit rendered less liable to damage from this quarter, a serious consideration in the South African climate.

Recently, a campaign has been opened in the eastern parts of the United States of America against the use of fruits which have been sulphured. It is not supposed that this will have any effect upon the continuation of the practice, which is quite innocuous. Sulphur has always been looked upon as beneficial to mankind from the days of infantile brimstone and treacle to the sulphur springs in later life. A scientific investigation into the practice of bleaching hops for beer making resulted in a report that the hops were not injured, neither was the beer. As far as I am aware no investigation has taken place in the matter of "sulphured" fruit to date, but it is quite likely that such will occur at the instigation of Californian fruit driers, who have absolute faith in the system, and are half inclined to think that the question has been raised by eastern fruit growers who have not the interest of the west at heart.

After the time for "sulphuring" has expired, the fruit is taken out and spread in the sun to dry, the side of each tray resting on its neighbour, so that a slight current of air is in motion beneath. The length of time taken in drying varies according to the sun's heat and other circumstances, such as night dews, the size of fruit, etc. Approximately, for apricots one may say in the Transvaal six days, and from eight to ten for peaches. Apricots should be taken up when they have reached a leathery consistency and feel dryish and tough in handling: they are then thrown into a heap in a cool room with a clean board floor and allowed to sweat for a week; this admits of the fruit which has been dried a little too much absorbing moisture from that which may not have been dried quite sufficiently, and vice versa. The heap should be turned over occasionally so as to admit of each portion of it receiving the same dryness, and when this has been attained it is ready for grading and boxing.

Grades as originally laid down by the West Side Fruit-Growers' Association of Santa Clara, California, of which the writer was one of the first members, were called prime, standard, choice, and fancy, and they were formed to embrace size, quality, and colour. It is to be feared that much of our dried apricot product will be found under the grades prime and standard, at any rate until such time as the improved varieties of

recent import shall come into bearing. Dried fruit amounting to £29,491 was imported by the Transvaal during the year 1907. Plate No. 36 shows a typical fruit-drying scene on the farm De Fortuin, Wellington, C.C.

Boxing.

For choice fruit, too much care cannot be taken to give the best appearance, of course equal and perhaps even greater is necessary with fruit which is not quite so good. Boxes containing 10 to 25 lbs. are generally used for the higher grades, whilst larger sizes, as a rule 50 lbs., are used for the smaller grades.

Fancy pictures and lace paper edgings help to give an attractive appearance to the fruit. Packing should be as follows :—

Facing.—Girls only should undertake this, and it forms a light, pleasant, and profitable employment. The boxes having been put together with the top nailed on, the paper lining and edging is placed carefully round, the box being turned face downward on the table. The fruit, which has been manipulated so as to bring it as much into the desired shape as possible, is placed carefully piece by piece until the face of the box is completed, then a second layer is placed in, covering any spaces which may be left in the first, sometimes a third layer is placed also, but as a rule the two layers only, then the box is handed over to be filled with fruit equally as good as the facing layers. This is, however, usually thrown in, not placed, the box placed on a press, correct weight obtained, the fruit pressed in, bottom nailed on, the box is taken out and turned over, the bottom then becoming the top. The correct naming of the contents is of the utmost importance, also correct weight, and another of the chief objects to be attained is continued uniformity of grades, so that customers can rely on getting what they ask for and not a size smaller.

The remarks with regard to the process to be observed in handling apricots apply equally to peaches, excepting that the latter fruit should be a little drier than the apricot when taking them up from the trays. Peaches, of course, may be dried either peeled or unpeeled. South African purchasers prefer peeled fruit when it can be obtained at a reasonable price. For the producer, the question is which will pay best if there is a good demand for both peeled and unpeeled. A good deal will depend on the class of peaches one has to deal with. We are are unfortunately almost entirely without a really first-class yellow peach suitable for drying purposes, a state of affairs which is rapidly being remedied, but to-day the question centres largely round the ordinary "Transvaal Yellow." This fruit scarcely pays to peel, in addition the process is tedious, but there is always a certain demand for peeled peaches, which it would be well to supply in order to prevent business going elsewhere. Experience gained at the Government Experimental Orchard, Potchefstroom, shows that about 4½ lbs. unpeeled of this fruit go to make 1 lb. dry, about 12½ peeled, and about 7 lbs. apricots also go to the dry lb. Peeling may be done by machines made for the purpose, but this is often unsatisfactory, and hand-peeling is perhaps preferable in the case of such peaches as the Transvaal yellow, which has an exceedingly light thin skin. Many kinds of peaches with somewhat loose and hairy skins may be sulphur skinned. This means that the fruit is cut as for drying, placed in the sulphur box for fifteen minutes, and taken out, when the skins may be taken off readily and thrown away ; afterwards the fruit goes back into the sulphur box for another twenty-five minutes. Peaches handled in this way have a nicer appearance than when peeled by hand : they also lose considerably less in weight.

Evaporation.

Evaporation of peaches and apricots takes place identically on the same lines as those already mentioned for sun drying, with the exception that the evaporating machine takes the place of the sun.

Under these circumstances it will be recognised that much depends on the kind of machine used, and it is to be regretted that we have comparatively little accurate data to guide us in the selection of absolutely the best machine to secure. In the State of Oregon, U.S.A., where the bulk

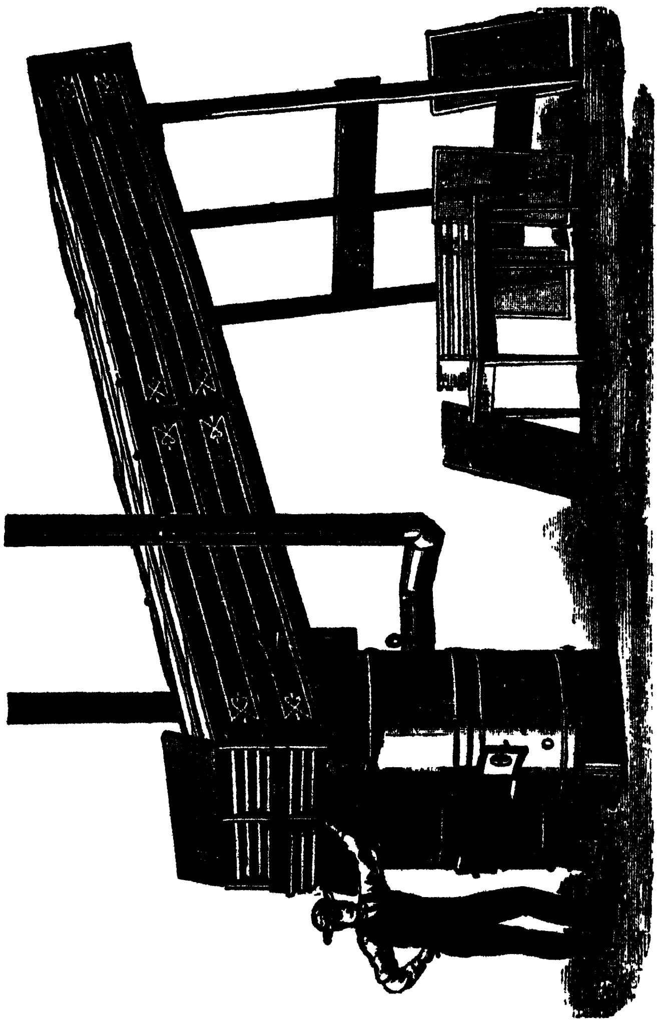


Plate 37. **"Invicta" Evaporator No. 4.**
18 feet long, 7 feet wide. Drying capacity, about 3,500 lbs. of apples in 24 hours.

of the fruit-drying industry is carried on by means of evaporation, there have been of necessity large numbers of attempts to produce a machine which shall be absolutely flawless. So far, no machine has been found which will adapt itself successfully to all conditions. In this Colony, there are at the present time four different makes of evaporators practically under trial, and the largest of these, that at the Government Experimental Orchard, Potchefstroom, is only a comparatively small machine. They have, all of them, done fairly good work. Plate No. 37 shows a make which

is stocked in Pretoria, one of the only ones to be obtained in South Africa. The machine shown is light and easily handled, and costs from £20 to £60, according to size. This includes trays, which are supplied with all makes of machines. It is to be expected that as fruit drying becomes more general, progress will be made in the selection of the evaporator most suited to our particular conditions, and this is an important point, for unless our climate undergoes a most unlooked for and undesirable change, it is upon evaporation that success in the future must rely.

It may be of interest to state that as a result of last year's work at Potchefstroom, dried apricots were produced which, for quality and flavour, left nothing to be desired. Apricots are generally a little small up here; they are too far away from the sea for the best fruit to be obtained. Peaches, owing to lack of quality, were not quite as good, but quinces, a fruit with the drying of which I have had no previous experience, were quite good. No apples were dried, nor any pears, the reason was that where the market for green fruit is good it is folly to go to the trouble of drying and possibly getting a lower price. Apples and quinces are dried more readily in an evaporator than any other fruit; the reason for this is that the ring sections into which they are cut are much thinner than any ordinary fruit, and give up their moisture more readily. For both these fruits a machine is to be obtained which slices and cores them at a single operation. It is not an expensive machine, being about 8s. to 12s., but it is indispensable for quick handling. After the fruit has passed through the machine, it is minus the core and cut into one long continuous slice, still retaining its original form.

In this condition each fruit is taken and immersed in weak salt and water until sufficient has been done to put in the evaporator, the object in this is to retain the colour and prevent the browning, which occurs so rapidly on exposing these fruits to the air after peeling. Each fruit is then cut transversely down one side with a knife, thus reducing it to a series of rings. These are placed in the evaporator trays, which are replaced in the machine and the drying process is entered. On completion of this the fruit is withdrawn and undergoes much the same treatment as mentioned previously. Sometimes these fruits have to be sulphured also, and this is especially the case in sun drying.

Evaporation of fruits, to be perfect, must not be a rapid process, it should rather be as lengthy as one can find patience to make it. Rapidity of evaporation means imperfectly dried fruit, possibly cooked on the outside and untouched within.

For the production of the best article the heat should be so regulated that it should be at a minimum when the fruit is put in, and a maximum or thereabouts when it is taken out.

The best fuel to use is undoubtedly coke, or coke and wood, coal, though often more plentiful and cheaper, does not produce such a good article, and fruit dried with heat from coal is apt to retain a flavour which does not improve it.

It may be thought strange that no mention has been made here of drying the French prune, fig, and perhaps other fruits. The reply is that in the Transvaal there are no prunes to dry, no figs of the right sorts, few pears and plums, and those there are can be more profitably marketed in a green condition.

The French prune industry has come to stay in Cape Colony, and a large acreage is now under cultivation. The writer has not yet felt justified in advising anyone in this Colony to plant French prunes, although as a dried product it is the largest in the world. Something definite is expected at an early date in the shape of results from Government experimental plantings, but until satisfactory results are obtained, it is not considered advisable to recommend the extensive or even limited planting of this fruit. There are too many thousands of unproductive fruit trees in the Transvaal at the present time: these all serve as a warning to the writer to be most careful in making recommendations, and are largely accountable for the conservative attitude adopted.

EXPORT OF ORANGES FROM THE TRANSVAAL.

By R. A. Davis, Government Horticulturist.

The experimental export shipments of oranges from this Colony made by the Department in 1907, although only on a small scale, established the fact that it was possible for us to send this fruit to London per ventilated hold of the mail steamers, and that it would arrive in good condition.

The inauguration of a special export rate by the C.S.A.R., enabling us to send fruit from any station in the Transvaal to London at an approximate cost of 2s. 2d. per box, placed its profitable marketing within reasonable limits of possibility.

It was necessary, in order to make the export worth handling, to get growers together and form societies for the carrying out of the business on proper lines, so with that end in view the Co-operative Organiser and myself visited the various citrus centres of the Colony, stating what we considered the possibilities of such an export business would amount to.

We were successful, thanks largely to Mr. J. A. du Plessis and other large growers, and Mr. L. Jacobsz, M.L.A., in forming a fruit-growers' co-operative association at Rustenburg, which was joined by the majority of local growers. In no other case was such an association formed, so that Rustenburg stands first on the list of exporting districts. Individuals, however, in the neighbourhood of Pretoria took the question up, and some successful shipments were made.

Assistance was rendered by this Department in such matters as securing box material, wrapping paper, etc., at the lowest possible price, the supplying of grading machines, and instruction in packing, and it is gratifying to note the rapidity with which the routine work of a packing-house was grasped by the local "employees" engaged in the business. By the end of the season a good staff of expert workers was obtained in both districts, and next year no difficulty will be experienced in this direction.

The freight has already been mentioned, in addition, insurance, boxes, paper, nails, and strap iron brought up the cost of a box of approximately

150 oranges to 4s. 6d., and to this amount must be added the expense of packing and hauling.

The method of shipment was reduced to the simplest form possible, consignments being handed over to the C.S.A.R. Administration, who attended to payment of dock dues and freight, and placed the fruit in the hands of the Transvaal Agent-General in London, who in turn gave it to a broker for sale. The proceeds were cabled out, the C.S.A.R. deducted cost of freight by land and sea, and remitted the Agricultural Department the amount due for boxes and packing material, handing the balance over to shippers, thus the whole business was done without the necessity arising for growers to put their hands in their pockets for a single penny.

Some slight criticism was offered on one occasion by the broker who sold the fruit, on the packing. In the opinion of the writer this was scarcely justified, as the uniformly good condition in which the Transvaal consignments arrived would not have been maintained had the packing been faulty.

Naturally, oranges packed by anyone entirely new to the business cannot be expected to compare with the work of expert packers, and an occasional fruit out of place might have been expected. For the information of our growers, an extract from the letter from the broker is appended, as are also a few comments on the general condition of Transvaal fruit on arrival. For these the writer is indebted to the courtesy of the local agent of the Union-Castle Steamship Company.

Considering that the whole of our shipments were carried in the ventilated parts of the hold of the mail steamers, and that not six boxes out of over 2,000 were lost in repacking owing to waste, I think shippers have every right to be satisfied. This fact alone speaks volumes for the carrying qualities of Transvaal grown citrus fruits, and undoubtedly stamps our high uplands as pre-eminently suitable for orange culture. True, we need a little, a very little, irrigation, but as compared with the results of shipments from the eastern coastal districts of Cape Colony and Natal, which rejoice in a moisture-laden atmosphere, we have every reason to congratulate ourselves on the position we hold.

With regard to the prices obtained for our fruits, it is not perhaps desirable to make public the affairs of private interests, but copies of the *Fruit, Flower, and Vegetable Trades Journal*, of London, published 22nd August, 5th September, and 19th September, gives the following :—

22nd August : Transvaal ordinary, 5s. to 20s. ;
5th September : Transvaal ordinary, 8s. to 10s. 6d. ;
19th September, Transvaal ordinary, 7s. to 10s. ;
and from these figures a fairly good idea of prices ruling may be obtained.

The fruit sent consisted of grape fruit, oranges, and some naartjes.

The grape fruit was not as highly appreciated as last year, although the bulk of it came from the same trees. The remarks of the brokers who handled this fruit in 1907 are as follows : "This small parcel came to hand in good condition, the only fault with it being that the skins were a little coarse and thick. What we receive from the West Indies and Jamaica

are fine, smooth skins, and make double the value, although the eating part of the fruit shipped by Mr. Turner was far superior to the supplies from Jamaica and the West Indies." From which it will be gathered that this fruit was not considered really second rate. In the 1908 shipment we appear to have fallen from grace. It is admitted that part of the fruit was small and that other portions of the consignment were not up to the 1907 standard. It is only fair to submit the comments received on this consignment, so that our growers may be able to improve their varieties.

"I regret to inform you that the last consignment of grape fruit has sold no better than previous lots, and if you anticipate further consignments I would respectfully suggest that it is advisable to cable the Government earnestly warning them against shipping more grape fruit, and perhaps go the length of withdrawing the cheap railway rate in the case of grape fruit. Hitherto the London market has been almost bare of grape fruit, with the exception of small parcels from the West Indies, and even with this empty market they have been most difficult to sell, and realised prices which I fear will not pay expenses. Yesterday Messrs. Elder & Fyfe issued a circular to the fruit trade that they may expect heavy consignments of oranges and grape fruit during the next fortnight, and after that heavy shipments at regular intervals. I would solemnly warn you that when these grape fruit arrive, it may be impossible to get a bid for the Transvaal ones, and utter loss result. In the case of the oranges, the present price will necessarily fall, but in my opinion there will be a safe market at 7s. to 10s., and hope even higher. In future years the Transvaal must attempt to have their oranges in as early as possible, even at the expense of picking them rather on the green side.

"Oranges.—This week's consignment is selling at from 10s. to 12s., going to Glasgow, Manchester, Birmingham, and Hamburg. Their condition has been sound, considering the quality which was shipped, but I would advise shippers to study the appearance of their packing with greater care and keep their rows more evenly. This consignment from the Rustenburg Co-operative Association was not packed quite so carefully as the last. I would suggest that they use wrapping paper next year of a superior quality, and have their brand printed better, as it makes the open box on the market show off to better advantage.

"The packing is not bad, but it will pay to smarten it up. The trade is pleased at the uniformity of the cases throughout their depth. Occasionally a small orange is put in, and the buyers then claim to pay for this case at the rate of the smallest, in case there are others of the same size in the case.

"Oranges are practically a commercial industry, reckoning the phases they pass through between the grower, the broker, and salesman, and the different grades of retailers. The fruit must be packed with absolute mathematical accuracy, that all the immediate hands can guarantee it; so that it may one day reach a standard that foreign buyers can buy it without sending a representative to see it.

"Grape Fruit.—I regret that I can say nothing favourable about this fruit. It does not arrive here tasting sweet, and it looks very small against the huge, melon-looking grape fruit which comes from other places. I

took buyers from all the big London houses to look at it, and also buyers from the Hamburg firms, and shipping company buyers who take big quantities when they are cheap from the West Indies, but they are most emphatic in their condemnation of the Transvaal grape fruit, though appreciative of the oranges. Please warn all farmers against sending similar grape fruit."

* It may be mentioned also that five or six different varieties of this fruit are under test at the Warmbaths Experimental Station, and that from amongst these we expect to receive something which will prove more acceptable to the European palate in a short time.

The oranges sent were, with the exception of one solitary consignment, ordinary "Transvaal Seedlings." As before stated, the carrying quality of these is excellent, and it is to that fact that the prices which were obtained were realised. The one shipment referred to of another variety consisted of "Washington Navels," and the prices realised for this kind were far more satisfactory. Our growers must bear this in mind, that the English market is open to the world, and is accustomed to receiving fruits of the very best description, for which the very best prices are paid. They do not want and will not pay high figures for second rate stuff, so if our footing on that market is to be maintained we must see to it that our varieties are of the very best and no other. "Second to none" should be the motto for Transvaal orange growers, and they must bear that prominently in mind. As an instance of what has been done in other countries, I may mention the case of California. When orange-growing there was in its infancy nearly all the groves consisted of seedling trees similar to our own. Now the California orange is known all the world over as the best that grows, but all, or nearly all, the old trees have been improved or worked over to other kinds, and it is to that fact and the determination to produce nothing but the best that the pre-eminence of California as an orange-producing country is due to-day. Our people cannot do better than follow that example. They should plant Washington Navels, Thompson's Improved Navels, and any other good navels obtainable, and also a few good late kinds, such as Valentia Late and Du Roi.

Naartjes.—Comparatively speaking, only a few of these were sent, but those which went forward were well received, and, like the oranges, arrived in first-class condition; the English market likes a good, deep-coloured fruit, with a skin as dark a red as possible. Puffy, loose skins are not as good for shipment as are those having tight skins. Those sent were packed in small boxes containing two or three dozen fruits, a single layer in a box, and this method of packing appears to be quite satisfactory.

No lemons were sent; there are none to send of varieties acceptable in Europe. Even now we import hundreds of cases of Sicily and other lemons from Cape Colony and Natal monthly. They come also from Italy and Sicily in huge consignments when South Africa is bare, so we must not expect to export lemons for some time yet.

The best market for fruit in Europe is London, and for that reason all shipments were consigned there direct. Some trial lots were sent to Hamburg, but the prices realised were not satisfactory, and it is not anticipated that a profitable business can be developed with other European ports than London at present. As, however, facilities are offered in the

shape of direct shipments and reasonable freights, it is possible that eventually our fruit may find an opening at any rate at fair if not high prices. The export took place during the months of July, August, and September. Possibly shipments earlier in the season would also have been acceptable and fetched good prices. In the light of the experience gained in 1907, when complaints were not unknown about the sourness of our fruit on arrival, owing to shipments having been made in June, it was considered best to delay the opening of the season until July. Now, however, the opinion is general that next year we shall commence at any rate by the middle of June, and so avoid coming into conflict with the West Indian consignments, which usually reach the London market in October, and would materially reduce prices for the Transvaal article.

The size of box used was the usual standard size adopted by this Department in 1907, the number of fruits in a box of course depended on their size. Five grades were used, i.e. 96, 126, 150, 176, and 200, and out of these it was found that the 176 and 200's fetched in most cases the highest prices; this was, of course, due to the fact that buyers wanted the largest numbers they could get for their money. Possibly next season it might pay to pack 220's.

Brands.—It is customary both in South Africa, and, in fact, in all countries whence fruit is shipped, for growers to adopt a certain brand under which buyers know and recognise that they can procure a certain kind of article. Thus the Rustenburg Co-operative Society shipped under the "Rustenburg" brand. This is now known and appreciated; in purchasing this the buyers know just what to expect, and it would be unwise to change it.

In the opinion of the writer, it is a mistake to adopt fancy brands with no meaning attached to them, such as "Golden Cross," "Blue Anchor," etc. Such brands convey nothing to purchasers, whereas "Rustenburg" carries a definite meaning in that it is known that fruit packed under that brand comes from a place called by that name. As our different districts fall into line, each might well adopt as a "brand" the district name, except, perhaps, Pretoria, which might ship under the word "Capital."

In looking over a report by the Natal Entomologist (Mr. Fuller), who has had charge of the export business in that Colony, one is struck by the similarity of our experiences in some cases, and in the difference in others. The report is presented here, as it is considered extremely practical and interesting.

NATAL REPORT.

What We Have Learned.

1. In contradistinction to last season's experience, that it is most profitable to ship oranges to the London market from May until October.

2. That oranges produced upon the Natal uplands, from an elevation of 2,000 feet and upwards, possess excellent carrying qualities, and will carry well, either by ventilated hold or as deck cargo.

3. That oranges from the littoral, under present conditions of orchard management, will not carry on deck, by hold, or in the cool chamber, without a wastage of 25 per cent. to 90 per cent. occurring.

4. That for oranges and naartjes the early London market to the end of July is extremely profitable, that the later market is payable, and there are numerous continental markets to which it will pay to send first-class fruit.

5. That the wastage of coastal oranges and naartjes is due to the all-invading blue mould (*Penicillium digitatum*), and that its virulence is entirely due to physiological weaknesses of fruit grown near the coast.

6. That the only way to prevent this wastage is by producing fruit more strongly constituted, coupled with extremely careful handling, the best of wrapping, and thoroughly good packing.

7. The production of good, firm fruit, and the control of blue mould lies in orchard management, and in that alone.

8. That the Natal naartje has proved itself excellent of its class, and came as a surprise to all accustomed to the mandarins (as this fruit is properly termed) of the Mediterranean.

9. That the (so called) Natal mandarin did not find such favour with the market as the naartje, and that it does not possess the same carrying qualities.

10. That firm naartjes carry best, that soft ones carry badly, and that firm fruit is preferred to puffy by the home buyer.

11. That medium large naartjes, 2½ to 2⅝ inches in diameter, will pay better the season through than very large, 2¾ to 3⅛ inches in diameter, and small, 2 to 2¾ inches in diameter. This because, as the season advances, the large fruit loses its firmness, its juice, and its flavour.

12. That the Natal orange cannot be beaten for sweetness.

13. That large oranges pay better than small.

14. That "Navel" oranges ("Bahia," "Washington," "Riverside," or "Thompson's Improved") pay better than the common variety.

15. That it does not pay to export lemons, but that Natal lemons (smooth-skinned) were well commented upon.

Clause 1.—Our experience is that best prices are realised in July and August.

Clause 4.—We have not so far found continental markets profitable, but we know very little about them.

Clause 13.—In our case smaller sizes paid better than the larger ones.

On the whole our exporters have every reason to feel hopeful for the future of the business, but a reduction in sea freight is imperative if the trade is to develop as it should.

Reports on the Arrival of Transvaal Fruits in England.

1st July, 1908.—

"The Transvaal oranges this morning seemed particularly good in juciness and flavour."

25th July, 1908.—

"You will no doubt be interested to see the enclosed copy of a report from our Southampton office upon the condition of the fruit, *ex Norman*, including the oranges from the Transvaal by that

steamer. The result is very encouraging, and may be attributable, as we think, to the fruit being well and carefully packed in suitable packages, these being, in the case of the Transvaal oranges, cases of thin white wood, after the style of Spanish orange cases, which seem to have answered the purpose well."

From Transvaal, via Capetown.—25th July, 1908.—

A.G.

T. 83 packages oranges, in hold. Good ; cases made after style of Spanish orange cases.

From Transvaal, via Capetown.—22nd August.—

T.

A.G. 316 packages of oranges, main deck. Very fair.

94 packages grape fruit, main deck. Very fair.

5th September, 1908.—

"The Transvaal oranges, you will have noticed, have carried well from the beginning, which was a feature in view of the longer land distance travelled. It is clear that the whole secret of successful transport lies primarily in the selection and packing."

From Transvaal, via Capetown.—12th September, 1908.—

T.

A.G. 250 boxes oranges, No. 1 hold, main deck. Good.

12th September, 1908.—

"Transvaal (Rustenburg) oranges out of ventilated hold were again quite good."

19th September, 1908.—

"Transvaal (Rustenburg) oranges were again good as usual."

From Transvaal, via Capetown.—19th September, 1908.—

T.

A.G. 139 boxes oranges, No. 5 main deck. Rustenburg ; good as usual.

L.

26th September, 1908.—

"Two trial packages of naartjes from the Transvaal were as nicely selected, packed, and ventilated as the Rustenburg oranges, which arrive in such consistently good condition. These naartjes were in paper, lightly interspaced with wood wool, but one layer of fruit to the tray, thus securing abundant air space."

From Transvaal, via Capetown.—26th September, 1907.—

T.

A.G. 219 packages of oranges, No. 1 main deck. Rustenburg ; quite good as usual.

T.

A.G. 22 packages naartjes, No. 1 main deck. Good ; well ventilated boxes : in paper, interspaced with wood wool ; a single layer of fruit to each tray.

From Transvaal, via Capetown.—3rd October, 1908.—

T.

A.G. 15 cases oranges, main deck. Rustenburg ; good as usual.

T.

A.G. 35 crates naartjes, main deck. Good ; in paper, wood wool interspacing , good ventilation.

EXAMINATIONS IN SCIENTIFIC AND PRACTICAL HORTICULTURE.

The Agent-General for this Colony in London has forwarded certain communications with regard to the above subject, and they are now made public (see below) in order that should any candidates be forthcoming for the examination in April arrangements may be made for their entry in due form.

Whilst it is recognised that it is unlikely that more than a few will come forward on this occasion, it is considered desirable to point out that holders of the certificates granted by the Royal Horticultural Society are regarded as having attained a high standard of qualification in horticulture, and it is hoped that, in the future, examinations under the auspices of the society may be held in some part of South Africa.—R.A.D.

Royal Horticultural Society's Examination in Horticulture.

To the Acting Director of Agriculture.

Sir,—On the invitation of the Government of the United Provinces of India, the "General Examination" of this society in the principles of horticulture is to be modified so as to fulfil the local requirements, and a first examination will be held in April, 1909, at Saharanpur. This suggests that possibly other countries and districts may feel it desirable to enter candidates for a similarly modified examination, in which case the Council would doubtless be prepared to organise it.

The examiners are leading horticulturists in England, and for examinations abroad will be assisted by suitable experts acquainted with the special horticultural conditions of the various countries desiring to adopt our tests.

The general examination is now an acknowledged standard of qualification in horticulture in Great Britain, and it is thought it may be of similar advantage and assistance in your country. Other details arranged will be communicated on application for the examination, but the enclosed prospectus, as arranged for 1909, will indicate its general lines and the sort of knowledge required.

If you should think at any time of adopting this proposal I shall be glad to hear from you, when also I should greatly value the suggestion of the name and address of a competent person in Great Britain versed in horticultural conditions of your country, whom we might ask to co-operate with the other examiners appointed by the society.

Yours, etc.,
W. Wilks.

Royal Horticultural Society,
Vincent Square, Westminster. S.W.,
21st September. 1908.

Royal Horticultural Society General Examination.

Candidates must be 18 years of age or over.

Elementary principles on which horticultural practice is based :—

1. Soils, good and bad, their mineral composition ; chemical nature of fertilisers and their respective values.
2. The physiological values of water, heat, and air in plant growth.

3. The structure of seeds and their modes of germination ; the chemical phenomena of germination ; the movements of the seedlings and the uses of them.

4. The functions of roots, their anatomical structure ; hindrance of healthy root action and their remedies.

5. The uses of stems and branches ; the anatomical structure of ordinary dicotyledonous and of a monocotyledonous stem.

6. The physiological functions of leaves and the action of light upon them.

7. The structure of tubers and other subterranean stems ; the structure of bulbs and buds ; the general phenomena of vegetative multiplication.

8. The physiological processes undergone in growth and development : the structure of an active cell, and the process of cell division and the formation of tissues.

9. The structure of flower buds and of flowers ; the methods of pollination, natural and artificial.

10. The process of impregnation of the ovule, and the formation of the embryo and endosperm.

11. The classification and description of fruits ; the changes and development during ripening.

12. The general characters of the commoner families of plants in cultivation.

13. The origin of species.

Horticultural Operations and Practice.

1. Surveying and landscape gardening : Elements of.
2. Choice of site for garden.
3. Description and use of implements under each head.
4. Operations connected with the cultivation of the land, with explanations and illustrations of good and bad methods. Digging and trenching, draining, hoeing, stirring the soil and weeding, watering, preparation of seed beds, rolling and raking, sowing, transplanting and thinning, potting, planting aspects, positions and shelter, staking, earthing and blanching.
5. Propagation, elementary principles, cuttings, budding and grafting, stocks used, layering, division, branch pruning, root pruning, old and young trees and bushes, training.
6. Fruit culture : Open-air and under glass ; small fruits ; apples and pears ; stone fruits ; gathering and storing, packing, marketing ; selection of varieties, etc.
7. Vegetable culture : Open-air and under glass ; tubers and roots ; green vegetables, fruits and seeds ; rotation of crops and selection of varieties.
8. Flower culture : Outside and under glass.
9. Manures and their application.
10. Improvement of plants by cross-breeding, hybridisation, and selection.
11. Arboriculture : Trees and shrubs and their culture.
12. Insect and fungus pests : Prevention and treatment.

CITRUS EXPORT SEASON, 1909.

Conditions under which Assistance from the Agricultural Department may be Obtained.

The Right Hon. the Minister of Agriculture has decided to again afford assistance to exporters of citrus fruits on similar lines to those which were adopted last year, with the exception that no help can be granted to individual shippers or private firms. For such, the same freight rates would be available as last year, but it will be readily understood that it would be impossible for this Department to appoint inspectors for every individual shipper.

It is earnestly requested, therefore, wherever a body of farmers exists, which may be desirous of exporting citrus fruits, that they take the necessary steps to do so on a co-operative basis, and to notify the Co-operative Organiser of the fact. In the case of all Fruit Growers' Co-operative Societies the following offer is made :—

1. An inspector capable of giving instruction in packing, etc., will be sent free of charge.

2. Boxes and packing material may be obtained from the Agricultural Department at cost price.

3. A grading machine will be granted free for use for the first season.

The Forestry Section.

THE PROPER SEASON FOR FELLING TREES.

By Lionel E. Taylor, Assistant Conservator of Forests.

Enquiries are so constantly being made as to which is the proper season for felling gum trees, and also as to the height above ground at which they should be cut, that I think a short paper on this subject may prove of interest to farmers and owners of plantations.

Before discussing the best season for tree-felling and the results which may be expected from felling during the wrong season, it will be necessary to mention the various objects for which trees are grown.

In this country, trees are grown for one or other of the following objects:—

1. To provide windbreaks.
2. To furnish shade.
3. To provide timber.

As this paper is only intended to deal with the cutting of gum trees, I will not discuss the selection of species or the actual planting of the trees.

1. *Windbreaks.*—The conditions which have to be fulfilled in order that trees may form an efficient windbreak are that they should be tall and that their crowns should be dense. These conditions can be brought about by the following treatment:—When planted, the trees must be close together, in the case of gums six to nine feet apart. This will have the effect of drawing them up, but care must be taken that they do not grow too lanky or whippy, and as soon as they show signs of this they must be thinned, otherwise they will be liable to be broken off by wind. When thinning, all weak and suppressed trees should be cut off close to the ground, and where there are several rows of trees one or two of the outside rows should be clean felled, so that a dense coppice growth may be produced, to act as a protection against surface winds. This operation may be repeated every few years so as to maintain a dense growth near the ground. The effect of thinning will be that the remaining trees will have more room to expand their crowns, and will then put on a larger diameter growth at the expense of height growth, which will proceed at a slower rate than before. In this connection it must be remembered that the greatest increase in diameter takes place just below the crown, and trees with a clean stem and a high crown will have less tapering stems, and consequently more valuable timber, than those with a branchy stem and no pronounced crown.

It is interesting to note that experiments carried out in the United States of America showed that trees were effective as windbreaks for a distance away from their base equal to about twelve times their height.

2. *Shade Trees.*—These are usually only cut when they grow too high so as to defeat their object, or when they become a danger to buildings. In both cases pollarding may be resorted to. Gum trees

may be pollarded or cut off at any height from the ground, provided it is done at the right season (to be explained later on). The result is generally a mass of side shoots, some of which generally grow upwards and form a crown.

3. *Timber Trees.*—It should be the object of every one possessing plantations to provide for their natural regeneration after they have been felled. This may be brought about in the following ways:—

(*a*) By seed from the old trees;
(*b*) coppice shoots from the stools;
(*c*) growth from root suckers.

The only satisfactory method of bringing about the regeneration of gum trees is from coppice, although it may be obtained by natural seeding.

In felling trees with the object of obtaining coppice growth, the following rules must be adhered to:—

1. Felling must be done at the proper season.
2. The tree must be cut as close to the ground as possible.
3. Cutting must be done with a sharp axe, not with a saw.
4. The bark must not be severed from the wood round the cut.

1. The proper season for felling is just before the commencement of the period of activity; that is during the winter or resting period. This applies to both deciduous and evergreen trees. The reasons for this will be given later when I discuss the factors regulating the growth and destruction of the vegetable tissues.

2. It is most important that the trees should be cut close to the ground. If they are cut, say, at 2 feet or more above the ground a satisfactory timber tree will never be formed. This applies especially to gums, which have brittle timber, as there is a great danger of the shoots (springing from the side of the stump) breaking off at their junction with the stump when they grow to any height.

3. A clean, slanting cut should be made with a sharp axe. In the case of large trees, the cut may be given a slope from the centre to two sides, or it may receive the shape of a cone, but it must not slope inwards. The object of this is to prevent water lodging in the cut and causing the stump to rot. Where it is necessary to use a saw, the cut should be smoothed off with an axe after the tree is removed.

Apart from the fact that good trees will not be produced from stumps cut high above ground, there is a great danger in our hot climate of the stump cracking, and thus letting in water, which leads to decay. This may even take place in stumps cut close to the ground, but in this case the stumps could be covered over with earth to protect them from the sun.

The same rules hold good whether the timber is required for mining poles or for building material, but with the latter more care is required in seasoning the timber. This question of seasoning is a most difficult one, and it would require a special article to deal with it satisfactorily; suffice it to say that all trees required for timber should be cut during the resting period—winter—before the sap rises, otherwise the timber will split. The chief causes of timber splitting is the uneven drying out of the moisture in the wood, and the less

moisture there is in the wood the more evenly it will season. It must not be thought that trees are devoid of moisture during the resting period, as this is not the case, but, as I will explain later, the nature of this moisture is quite different during the active and resting period. In the former, there is a strong upward flow of water containing inorganic constituents in solution and a downward movement of food material, whereas in the latter the cells are filled with reserve material in the form of starch, etc.

In order to substantiate the statement which I have made regarding the periods of activity and rest, and to arrive at a conclusion as to the right season for felling trees, it will be necessary to discuss the factors regulating the growth and destruction of the vegetable tissues.

The commencement of activity of the protoplasm takes place in the roots from causes which are not definitely understood, but one important factor is temperature, and another equally important one is moisture. In trees or plants growing in a hot climate, a higher temperature is required to stimulate activity than is required for trees or plants growing in a cold climate, and eucalypts come under the first category.

Unless plants can absorb moisture, such activity cannot take place, and when the soil temperature is below freezing point it is physiologically impossible for plants to absorb moisture, however much may be present in the soil.

As soon as activity commences, water, carrying in solution the inorganic salts required by the plant for food, is absorbed by the roots. This watery solution or "sap" is carried upwards through the woody tissues to the leaves, and is there manufactured into more complex products in combination with carbon dioxide which has been fixed by the chlorophyll of the leaves under the action of sunshine. These products of metabolism (the continual chemical change going on in the plant) are then conveyed downwards from the leaves through the phloem situated under the bark in the form of easily diffusible glucose, which is later converted into starch and deposited in the wood cells. This process goes on all through the period of activity, and at the close of this period the maximum amount of food reserve (starch) is present in the tree.

There then comes a period of "rest." This is when the upward current of sap ceases, but for some time after changes take place within the tree at the expense of the reserve material, which becomes greatly reduced towards the end of the period of rest.

It is an established fact that every vegetable organism undergoes such a period of rest, whether it be the lowest form of plant life or the most highly specialized deciduous or evergreen tree. It is a popular falacy to suppose that evergreen trees are always growing, and in refutation of this I will quote the following from "Plant Geography upon a Physiological Basis," by the late Dr. O. F. W. Schimper, one of the most eminent botanists of modern times:—

"Evergreen woody plants in districts with precipitation at all seasons of the year are not endowed with continuous growth, but, like the deciduous woody plants, experience periodic alternations of rest and activity. The ebb and flow of vegetation is very striking in the case of trees whose foliage in youth is very light in colour, but assumes

a dark hue in old age. In such a case a tree remains for weeks, even for months, in its dark foliage; all its terminal buds are at rest. Suddenly the dark ground appears to be tipped with white or bright red: the foliage buds have flushed . . . even if it be more concealed there occurs in them the alternations of rest and activity that is common to all vital processes."

In temperate and cold climates the period of rest corresponds to the cold period of the year, and in tropical climates, and where the temperature varies little throughout the year, to the dry season. To again quote Schimper:—

"Tropical plants are just as subject to the periodic alternations of rest and of activity as are those of the cooler or colder zones. Wherever a sharp climatic periodicity prevails, the functions of the plant organism in the tropics also appear to be decidedly influenced by it. These dry seasons act like cold ones in many respects. The less marked the periodicity of the climate is, the less dependent on its influence is the periodicity of the plant. Internal causes are mainly or solely responsible for the alternation of rest and of activity in a nearly uniform climate. Such a rhythmic change is, however, never abandoned, for it arises from the nature of the living organism and not from external conditions; its connection with external conditions is a secondary feature—an adaptation. Hence the picture of general and continuous activity, which most travellers have brought with them regarding the vegetation in constantly humid districts, is an illusion."

A well-known example of this is the orange tree, which has very marked periods of quiescence.

The fall of the leaf is not connected with the flow of the sap, but is governed by inherent characters in the tree. It may be said that the fall of the leaf in deciduous trees corresponds with the commencement of the period of rest, but this is very easily explained. Leaves may be divided into two main classes. (1) Tender leaves which are particularly adapted for transpiration—such as the leaves of all deciduous trees (2) Coriaceous or leathery leaves—such as those of evergreen trees—possessing mechanical devices to regulate transpiration. It must be explained that when the sap reaches the leaves and new compounds are formed, an excess of water remains over, and it is necessary that this should be got rid of; this takes place through the leaves by transpiration of watery vapour. If more water is being transpired than can be supplied by the roots, the leaves wilt, and if this goes on for long enough the whole plant suffers. It can be readily seen that if leaves specially adapted for transpiration were to remain on the tree during the winter, when the roots are not able to absorb moisture, very serious consequences would result; hence the tree sheds its leaves. The case of trees with leathery leaves is different; they do not transpire so freely, and possess mechanical devices for the regulation of transpiration. The bringing into action of these devices is dependent on several causes, the most important of which are temperature and humidity of the air. If the temperature is lowered below the optimum required by the plant, the guard cells of the stomata—the mechanical device—commence to close and transpiration ceases. This protects the plant from the loss of water when the temperature is too low to permit of water being absorbed

by the roots. Again, when the relative humidity is low, and when consequently transpiration would be most active, the guard cells close and transpiration ceases. It will be seen that trees possessing leaves furnished with these devices have no occasion to shed their leaves.

The leaves of eucalypts are specially furnished with such devices, and, in addition, many of the species have leaves covered with "bloom"—a gummy exudation—on the upper surface, as a further protection against evaporation, the mechanical devices being on the lower surface.

Another argument which may be advanced against many trees being dormant in the winter is that flowering takes place during that season. This is the case with many eucalypts. Before giving the scientific explanation of the development of flowers, I may state that it is in no way connected with activity of the rising sap, the constituents of which are useless as regards food material until they have been transformed into more complex materials through the agency of the leaves. In support of this, I may quote the case of oak, ash, and most fruit trees which bear flowers before the leaves are formed, and which, therefore, cannot benefit from the leaves which are non-existent. The actual source of the food material required for the production of flowers is the reserve material stored up in the tissues of the plant during the previous period of vegetative activity, and the factors governing the actual time of flowering are temperature and dryness of the soil or atmosphere. It is a well-known fact that low temperatures favour the formation of flowers in temperate zones; this is exemplified in the case of forcing of fruit trees where the temperature has to be always kept low during the period of flowering. The comparatively high temperature in this country during spring accounts for the fact of many European trees and shrubs, such as laburnum, lilac, etc., failing to flower. In tropical zones flowering nearly always take place in the dry season. To again quote Schimper:—

"The blossoming of woody and tuberous plants, everywhere within the tropics, is most abundant during the dry season, or immediately after it; and these are precisely plants in which the production of flowers is not directly dependent on foliage. . . . The rhythm that is witnessed in leaf-formation is observable also in the flower. The production of flowers exhibits a correlation with the seasons of the year whenever the seasons display sharply-defined differences. In the reproductive domain, this dependence is likewise a secondary feature—an adaptation to external factors on the part of physiologically necessary processes. In the tropics, an influence associated with variations in temperature is exhibited only in border districts. . . In most cases during the greater part of the reproductive period there is a retardation, or even a stoppage, in the vegetative domain, and this may extend to the whole crown, when its habitat is to break simultaneously into flower, or it may be confined to the larger or smaller branches, according to their degree of individuality. The effect on the vegetative region is frequently limited to the discontinuance of the formation of foliage shoots; the vegetative bud rests. In many cases the antagonism between the vegetative and reproductive functions goes further. A tree or shoot preparing to blossom throws off its foliage, chiefly, however, from

the flowering branches, whereas the purely vegetative ones usually retain their flowers.''

The following are the facts which I have endeavoured to establish in the above remarks:—

1. There is a period of rest in every vegetable organism, including evergreen trees.

2. The period of quiescence is dependent on inherent physiological characters in the plant, and, by adaptation, this period coincides with (*a*) low temperature, (*b*) dryness of the soil.

3. The sap does not rise during the period of rest, although physiological changes may go on in the cells.

4. During the period of rest the cells of the plant are filled with a store of reserve material.

5. The fall of the leaf is not dependent on the cessation of the flow of the sap.

6. The food constituents required for the formation of new foliage, after the period of rest, are supplied by the reserve materials stored up during the previous period of activity.

7. Flowering has no connection with the flow of sap, but is regulated by (*a*) temperature in temperate zones, (*b*) the dry season in warmer zones, both dependent on inherent characters in the tree.

* * * *

Having discussed the factors regulating the growth of plants, we are now in the position to judge of the results of interfering with any of these factors. It has been shown that the sap must cease with the cessation of vegetable activity, and that this takes place either during the cold season in temperate zones, or the dry season in warmer zones. In the Transvaal, both these zones exist, viz., the high veld, with severe cold and drought in winter, and the low veld, with very dry winters. On the high veld the winter may be said to last from the beginning of May to the end of August, and in the low veld the dry season from the beginning of April to the end of September, so that the period of activity of the sap would be from September to April on the high veld, and from October to March in the low veld.

It is an acknowledged rule that felling of trees should be carried out before the sap rises, and where regrowth is required this is most important. If trees are felled when the "sap is up," there is no reserve material left behind in the stump and roots, and even if the tree is capable of making any growth from the stump, this growth is apt to be weak and starved.

In many trees, felling when the sap is active is sufficient to kill them outright; others may make a weak regrowth, as is probably the case with most eucalypts, but in my opinion the regrowth will never be the same as that from trees felled during the resting period.

Although this article deals with the question of the felling of gum trees only, yet the principle applies to all trees, with the exception of trees felled for bark, such as black wattle, which should be cut when the growth is active. It must also be borne in mind that all trees are not capable of producing coppice shoots, the principal exceptions being pines and cypresses, regeneration of which can only be obtained from seed.

The Dairy Section.

THE THEORY OF BUTTERMAKING.

By Robert Pape, Superintendent of Dairying.

In *Maelkeritidende* some views of Dr. Orla Jensen were expressed on the newer theories of buttermaking which seem to me particularly lucid. As they treat of the theoretical bases of some of the practical rules for buttermaking, which I gave in Farmers' Bulletin No. 1, "Buttermaking," I give them here somewhat abridged.

But some explanations ought to precede about matters which Dr. Jensen presupposes to be generally known, but which may not be known to everybody here.

"*Fat-globules.*"—Fat is present in the milk in tiny drops of a globular shape. The fat-globules vary considerably in dimensions, the smallest showing a diameter of about 0·000006 inch, the largest about 0·00026 inch. These fat-globules are surrounded by a membrane consisting, according to some, of liquid, according to others of a proteid, called by Dr. Jensen "Proteinmembrane."

"*Under-chilling.*"—If a decanter filled with water is cooled slowly while the water is at perfect rest, the temperature of the water may drop considerably under the freezing point, without any ice being formed. This water is under-chilled. A slight shock imparted to the decanter or a particle of ice or other crystal introduced into the liquid results in a sudden formation of ice crystals and in a few moments the liquid is turned into ice.

Butter-fat shows a similar phenomenon. The small drops of fat may be considerably colder than the temperature at which butter-fat solidifies, and yet remain in the liquid state. A beginning of crystallisation will break the membrane enclosing the fat, and the fat will solidify.

"*Diffusion.*"—This expression means really "spreading." The best known example is that of the sunbeam, which brings light even in places not reached by the actual beam.

The first condition for the adhesion of fat-globules is that they have been partly liberated from the surrounding protein. According to Storch the chief point in buttermaking is, therefore, the breaking of the protein-membrane. However, it must be surmised that, at the same time, part of the under-chilled fat solidifies. In 1876, Soxhlet pointed out that fat-globules in milk, just like other under-chilled bodies, solidify by vigorous shaking, specially in churning. Storch is of the opinion that solidifying sets in only when the finished butter is submitted to pressure as is done on the butterworker.

This conflict of opinion disappears if we assume that the butter-fat (owing to easy solvability of the solid fat in the liquid fat) has neither a fixed solidifying point nor a fixed melting point, but, at an ordinary temperature, contains solid fat as well as liquid fat.

What is generally called the solidifying point of butter is the temperature (19°-25° C.) at which the first fat-crystals form, if the liquid mass is being chilled quickly.

The under-chilling at this point is so strong that the formation of the first crystal rapidly causes the formation of so many crystals that it looks as if the fat had solidified. If the cooling is done slowly, which gives the first crystals an opportunity to form before any appreciable under-chilling exists, then you cannot notice a distinct solidifying point. Then the crystallisation is gradual and the mass seems solid only at the moment that no more liquid fat is present than always adheres to the crystals.

The circumstance that fat-globules can be under-chilled to such an extent must be explained by their small dimensions. A complete crystallisation of the fat-globules is not possible without the loss of the globular shape. Therefore, the pressure exerted on the surface must be counteracted, and this pressure is proportionately larger when the fat-globules are smaller.

Surface pressure on the fat-globules hampers the crystallisation inside; they will only crystallise completely (if they do not lose their globular shape by a different pressure) at a temperature under the freezing point.

Churning only causes an increase in the solid constituents of the fat-globules, but not such a complete crystallisation that the surface becomes uneven. With the increase of solid constituents, the contents of the globules pass through all phases of elasticity and plasticity, to brittleness. The completely liquid drop of fat is completely elastic, which prevents an adhesion in this stage. The only changes that can occur are that some globules unite to a larger one, or that a larger globule is crushed into smaller globules.

When the butter-fat contains small crystals, it is plastic like damp clay. In that stage the fat-globules would retain each impression but for the strong surface pressure. The elasticity of the globules, however, is diminished to such an extent that, after every shock, they recover the globular shape only very gradually. This leaves time for gluing together by means of the liquid fat they contain. A large globule cannot be formed on account of the resistance of the crystals.

If, however, crystallisation is carried so far that only a very small amount of liquid fat is left, then a gluing together of the fat-globules becomes difficult as in the case of clay which has become too dry. Very cold cream is, therefore, as little fitted for churning as hot cream; very cold cream is well fitted, however, for "whipped cream," in which, according to Storch, the torn protein-membranes retain the air.

In churning, the fat-globules undergo two changes; one is the partial solidification, the other the gluing together. The partial solidification is most intense at the lowest possible temperatures; the gluing together, however, hardly occurs under 10° Cent. The best plan, therefore, is to chill the cream severely before churning, as, otherwise, it is doubtful whether even the smallest globules will solidify sufficiently before the butter begins to come.

If this does not occur, the quantity and quality of the butter decreases. The apparently sudden formation of butter is due to the fact that the crystallisation in the larger globules begins practically at the same moment, and from these reaches the smaller globules at the moment of contact. For this reason (as Soxhlet has shown) churning can be accelerated by adding to cream at once some cream in which crystallisation has already set in. The different factors in buttermaking will be dealt with here in their natural following order.

The Food.—The food has a very marked influence on the melting point of butter-fat, and the churning temperature should be regulated accordingly. A sudden change of diet can cause the formation of butter-fat with a lower melting point, and be the reason that the churning temperature is too high. This causes the butter to contain too much moisture.

Dimensions of the Fat-globules.—The proportion between the volume of the fat-globules in butter and the intervening spaces, or between fat and non-fat, decreases with the dimensions of fat-globules. Therefore, milk containing chiefly small fat-globules (i.e. the milk of cows at the end of the lactation period) can be the cause of making butter rich in moisture. Such milk (or cream) presents difficulties in churning, as the small globules experience a strong surface pressure and their concussion is not very forcible. This may enforce a raised churning temperature which, however, increases the moisture contents and decreases the butter yield.

Fleischmann communicates a case where "old milk" could not be churned under 24° C. Milk from Jersey cows contains particularly large fat-globules, and, therefore, it must be easy to make out of such milk butter with a low percentage of moisture.

Fat Percentage of Cream.—In rich cream the spaces between the globules are small; in churning their concussion is frequent and the butter comes quickly. But there is a danger that the small globules are not worked enough, and still, in liquid form, surrounded by their protein-membranes, are enclosed by the larger globules. This causes "fatty," or "oily" butter which, in working, is loth to part from the buttermilk.

Mesdag reports a case from his practice of a creamery always troubled by an excessive amount of moisture in the butter. He observed that cream containing 33·5 per cent. of fat was churned, and when cream containing 20 per cent. of fat was churned the defect was remedied.

Pasteurisation of Cream.—Experiments in the experimental laboratory have shown that the pasteurisation of cream decreases the percentage of moisture in the butter. The explanation must be that the protein, which contains most of the moisture, according to Storch, loses moisture during pasteurisation.

The Ripening of Cream.—As the bacteriological processes in cream effect changes in the protein, it may be assumed that the ripening process influences the moisture contents of the butter. According to Storch the moisture contents of acidified butter are frequently higher than in sweet butter, and Marcas maintains that

(within certain limits) the moisture percentage increases with the degree of acidity of the cream.

Churning Temperature.—From the explanation of the butter formation it follows that it can only occur at a temperature at which the fat-globules still contain sufficient liquid fat after crystallisation. They contain most liquid fat at a temperature between the solidifying and the melting points of butter-fat, and, in fact, the butter comes quickest when you churn at 20°-30° C. At this temperature, however, the yield is small, and the butter is very rich in moisture. Storch could churn butter in less than ten minutes at 29° C., but found that this butter contained 22 per cent. non-fat. Marcas has shown that, even when churning at normal temperatures (11°-18° C.), the moisture contents increase with the churning temperature.

In connection with this it should be remembered that the formation of butter is decided alone by the phase of the larger fat-globules. As soon as these conglomerate, butter is formed, whether the small fat-globules are liquid or not.

At comparatively high temperatures it is, however, impossible to cause in a short time crystallisation in the smaller globules. These are, therefore, enclosed by the larger globules when still in a liquid state, or remain in the buttermilk. Further, at a higher temperature, the larger globules are more easily smashed and divided into smaller globules, which enriches the butter in small globules. All these circumstances act together to increase the moisture contents of the butter and to decrease the yield.

Therefore, the best churning temperature is considerably lower than the best temperature for the forming of butter. Practice has shown that churning should not take less than thirty minutes to ensure that all fat-globules are worked sufficiently.

Treatment in Churn after the beginning of Butter-forming.—As the butter-grains concuss with more force than the microscopical fat-globules, a cooling of the surface (washing with *cold* water) and a slow turning of the churn is required to prevent this concussion from engendering too much heat and causing the grains to melt together. This would cause overworked butter which tenaciously retains the buttermilk when on the butterworker. In washing butter the buttermilk on the surface is replaced by water; this is more liquid than buttermilk, causes diffusion processes in the butter-grains, and, therefore, the washing promotes the loss of moisture during working. But it is of paramount importance that the water should be *cold* so that the butter-grain does not "pack" too much before the enclosed moisture has been expelled.

Working.—The butter obtained by churning is an agglomeration of butter-grains, which consist again of agglomerations of fat-globules. The spaces between the butter-grains are the drainage pipes through which the buttermilk escapes during working. As the butter-grains increase in size the drainage pipes increase in size, but are reduced in number. It will be seen readily, therefore, that, in churning, the butter-grain must not be too large in order to insure that (on

account of the pressure exerted in working) the buttermilk may move easily in the interspaces.

Working has the following effect: First the butter-grains are brought closer together. This flattens them at the places where they touch; this decreases the spaces and liquid is pressed out. The pressure penetrates into the inside of the butter-grain and tries to flatten the several fat-globules, which, again, results in liquid being pressed out and forced into the drainage pipes. If the fat-globules are to lose the globular form then they must possess a certain firmness, otherwise they would, after cessation of pressure, resume the globular shape and suck back the expelled moisture. If the fat-globules are still mainly liquid it is even possible (specially at the surface of the butter) that, during working, they are divided into smaller globules. This increases the interstices and the butter will absorb moisture instead of losing it. Further, the drops of moisture become so small that it is hardly possible to expel them. If, therefore, working is to have the desired effect, the fat in globules must, through previous treatment, have been brought pretty far into the plastic stage. Only in that case the fat will lose the globular form during working, and crystallisation will go as far as the temperature of the butter-fat permits.

This makes it clear that butter should be worked at a low temperature. The temperature may not be too low, however, for then the butter-grains on the table would not cohere sufficiently, and "crumbly" butter would be formed.

Butter grows warmer during working, and, therefore, it is necessary (as Segelcke has pointed out first) to interrupt the working frequently and cool the butter in the intervals to expel sufficient moisture. The more butter is worked the more moisture will be expelled, specially when the intervals are long, for the crystallisation which causes the firmness of the butter-fat takes time.

Working is the factor which has the greatest influence on the moisture contents of butter, and an insufficient or wrong working is the most frequent cause of an excessive percentage of moisture in the butter. Marcas maintains that it is possible, by repeated working after sufficiently long intervals, to reduce the moisture contents of most butters to 8-9 per cent., a procedure which, of course, lowers the quality of the butter.

Salting.—Salting is of great assistance in expelling moisture by working. Therefore it is easier to evade a high moisture percentage in salted butter than in fresh. The drying action of the salt is caused by its property of attracting moisture. Round every grain of salt, water collects in which the salt-grain dissolves. Part of this brine spreads through the butter, and part is pressed out by the working. As it is easier to expel moisture from butter when the moisture collection is larger, the butter-salt must not be too fine. On the other hand, no coarse salt may be used, for this would not dissolve entirely in the moisture, and salt crystals visible to the naked eye are no longer tolerated in butter. The salt should be divided evenly over the butter to ensure even moisture contents throughout. The dryer the salt is the stronger it will attract the moisture, and the easier it will be to divide it.

MILK FOR CONSUMPTION.

By Robert Pape, Superintendent of Dairying.

On the dealers supplying the public with milk for household use, rests, if not the legal, then the moral, obligation to provide only sanitary, pure milk, harbouring no dangers to health. In former years this topic drew little or no attention, so little even that milk could be sold with impunity containing an amount of impurities which would have led to the like condemnation of drinking water as injurious to health. In later years authorities have been occupying themselves with the conditions of the milk trade, and have made regulations which are made more stringent year after year.

The purpose of these pages is not to give a summary of regulations for the milk trade in different countries, but just to mention a few measures the milk trade itself can adopt to assure a hygienic milk supply. Plate 38, fig. 1, shows the cotton-wool filter. The comparison of the used and unused cotton-wool shows clearly how much dirt can be drawn from the milk by means of this instrument. The milk dirt tester (Plate 38, fig. 2) serves to test the impurities in milk. The cylinders are filled with milk and left for a couple of hours, after which the sediment collected in the glass tube is noted. Sometimes the tubes are separated in the Gerber apparatus, and the amount of dirt is noted after separation. Part of the dirt is lighter than the milk, and will be floating on top as an unappetising layer.

Milk in the udder of the cow contains no dirt, therefore all impurities must be introduced during and after milking. And as milk in the udder contains no dirt, it is evident that measures can be taken to prevent the introduction of dirt into milk.

The cotton-wool filter separates the greater part of the impurities from the milk, but part of the dirt in milk is soluble, or so minute that it will pass through the filter. Further, dirt is always accompanied by germs, causing the decay of milk, which should be prevented, and not remedied afterwards. This requires the most scrupulous cleanliness of all implements coming into direct or indirect contact with the milk.

Pails and churns should be rinsed in cold water, scrubbed with a hot soda solution, and rinsed in cold water again, and if boiling soda solution can be used, so much the better. The dairy should be scrubbed twice a day with hot water, each time after the treatment of milk, and be kept airy and fresh by a well regulated ventilation.

The construction of the dairy should be such that no opportunities arise for the accumulation of dirt. Wooden floors are unsuitable, because dry wood will absorb spilled milk, which can be dislodged with the greatest difficulty only in scrubbing. Such spilled milk decays and creates a foul atmosphere. The floor should be made of a hard, smooth, impervious material like cement. Sharp corners between floor and walls are rounded off with cement, which facilitates cleaning. The walls are either painted or plastered white. Any specks of dirt show at once on a white surface, whereas a dark surface will hide dirt stains. By giving the outside of the building a white colour, it becomes easier to keep the dairy cool. Care should be taken that the cleaning water cannot soak into the soil close to

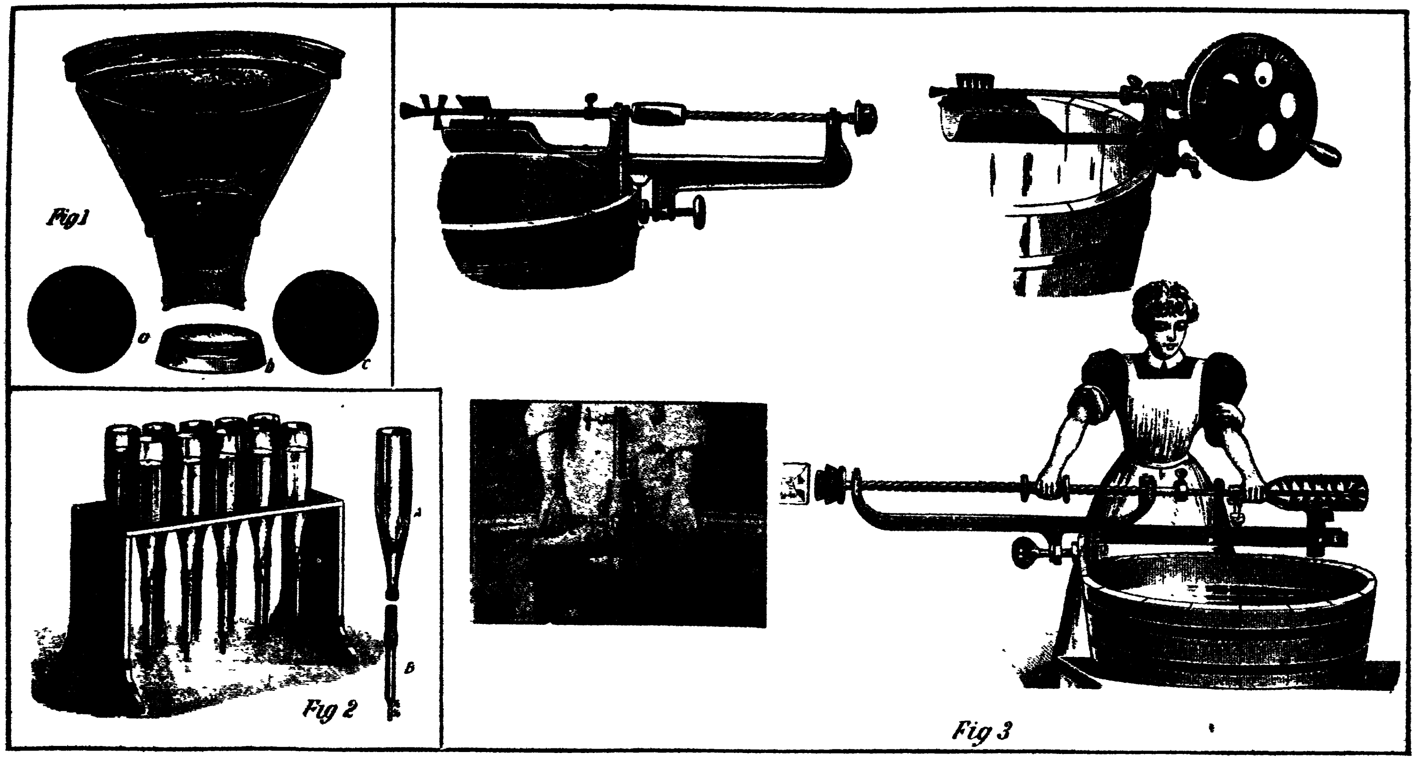


Plate 38.

Fig. 1. Milk Filter. (*a*) Used cotton wool, (*b*) filter complete, (*c*) unused cotton wool.
Fig. 2. Apparatus for testing dirt in milk.
Fig. 3. Improved Bottle-Washing Machines

the dairy and foul the soil and vitiate the air. If metal ware is used this should be well tinned with an alloy containing not more than one per cent. lead or enamelled with lead-free enamel.

In the stable the feeding of the cattle and the bringing out of the manure should always be left until the milking is finished.

For the cleaning of bottles special instruments have been designed. (Plates 38 and 39, figs. 3 and 2.) In this respect the public can aid considerably by rinsing milk bottles at once after emptying and keeping them filled with water till the purveyor fetches them. This prevents milk drying on the glass, and greatly facilitates the cleaning of the bottles. The shape of the bottle should render cleaning easy; sharp seams and bends must be avoided. Plate 39, fig. 1, shows a good milk bottle, which, however, could be improved in the bottom part.

The best system of closing the bottle is the cardboard disk, thrown away after use. As a rule, the closing stop creates difficulties in cleaning, and by using it only once these difficulties can be evaded. The cleaned bottles should not stand straight, as this would allow dirt to sift in. A good system of storing bottles is the bottle rack, shown on Plate 39, fig. 3.

But even if the impurities give no occasion for condemnation, other circumstances may influence adversely the food value and fitness for human consumption of milk.

First the fatty contents. Good milk should contain a certain minimum of milk fat, and this minimum has been fixed by regulation in certain places. On Plate 40, figs. 1 and 2, and Plate 41, fig. 1, can be seen the various parts of the Gerber apparatus, an instrument which, after some practice, enables you to check the fatty contents of milk with ease and despatch. The directions for use are omitted here, because it is better to learn the application under the guidance of a man who has a good practical experience of the instrument.

Plate 40, fig. 1, shows various shapes of separators, and Plate 41, fig. 1, the test bottles.

Plate 42, fig. 1, shows a picture of some patterns of automatic pipets for the measuring of sulphuric acid and amylic alcohol.

For testing whether milk contains fermenting germs, an apparatus (Plate 42, fig. 2) has been designed for the fermentation of milk. If milk be kept during twelve hours at a temperature of 40° C. (107° F.), then certain germs, if present, will develop better than others, which flourish best at a somewhat lower temperature. Just those germs that ferment the milk flourish best at a temperature of 40° C. The glass cylinders are carefully cleaned and sterilised in boiling water. Then they are filled with milk, closed with the lids, and put in a hot water bath kept at temperature by a spirit lamp. After twelve hours the samples are tested on flavour and smell.

As a rule this test is combined with the cheese fermenting test. Of each milk sample two cylinders are filled and to one of these cylinders a couple of drops diluted rennet are added. After twelve hours this cylinder will contain a small cheese floating in whey. The cheese is cut open and judged according to the fermenting holes found. This test is very sensitive, but requires the utmost care in the cleaning and sterilising of the cylinders.

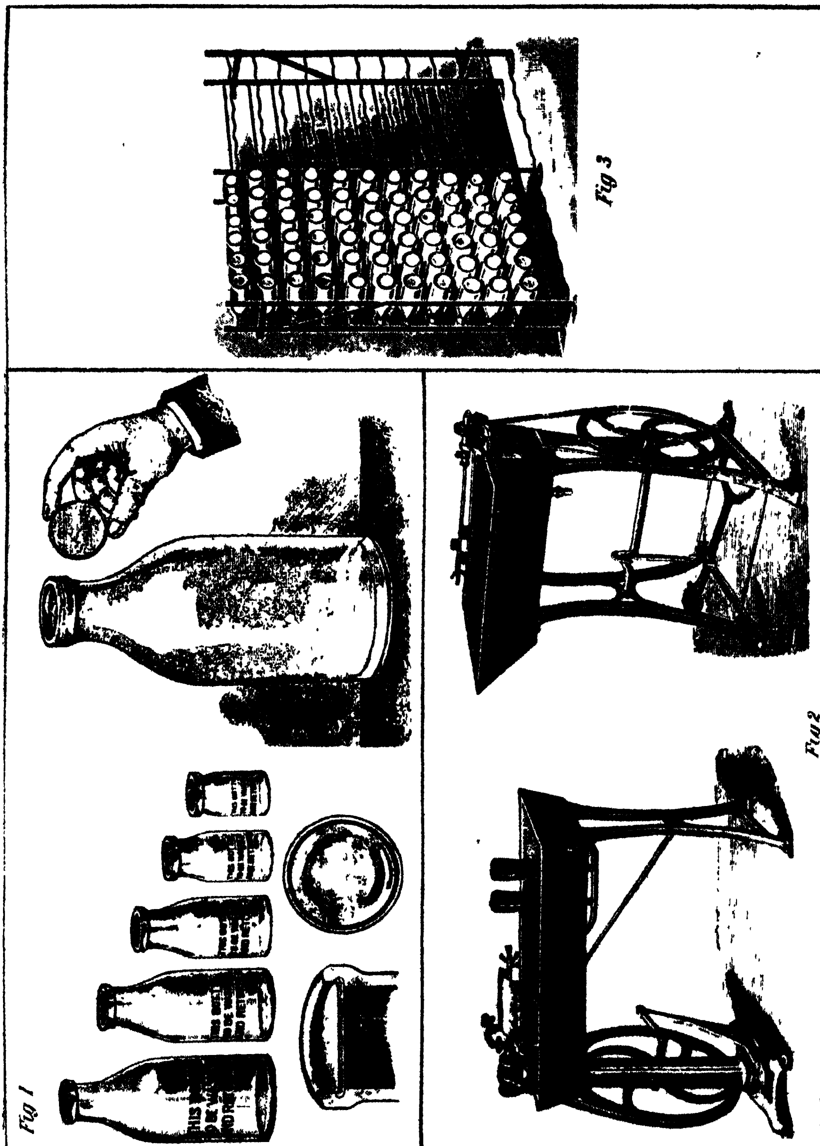


Plate 39.

Fig. 1. Sanitary Milk Bottles. Fig. 2. Bottle-Washing Machines.
Fig. 3. Storage Rack for Milk Bottles.

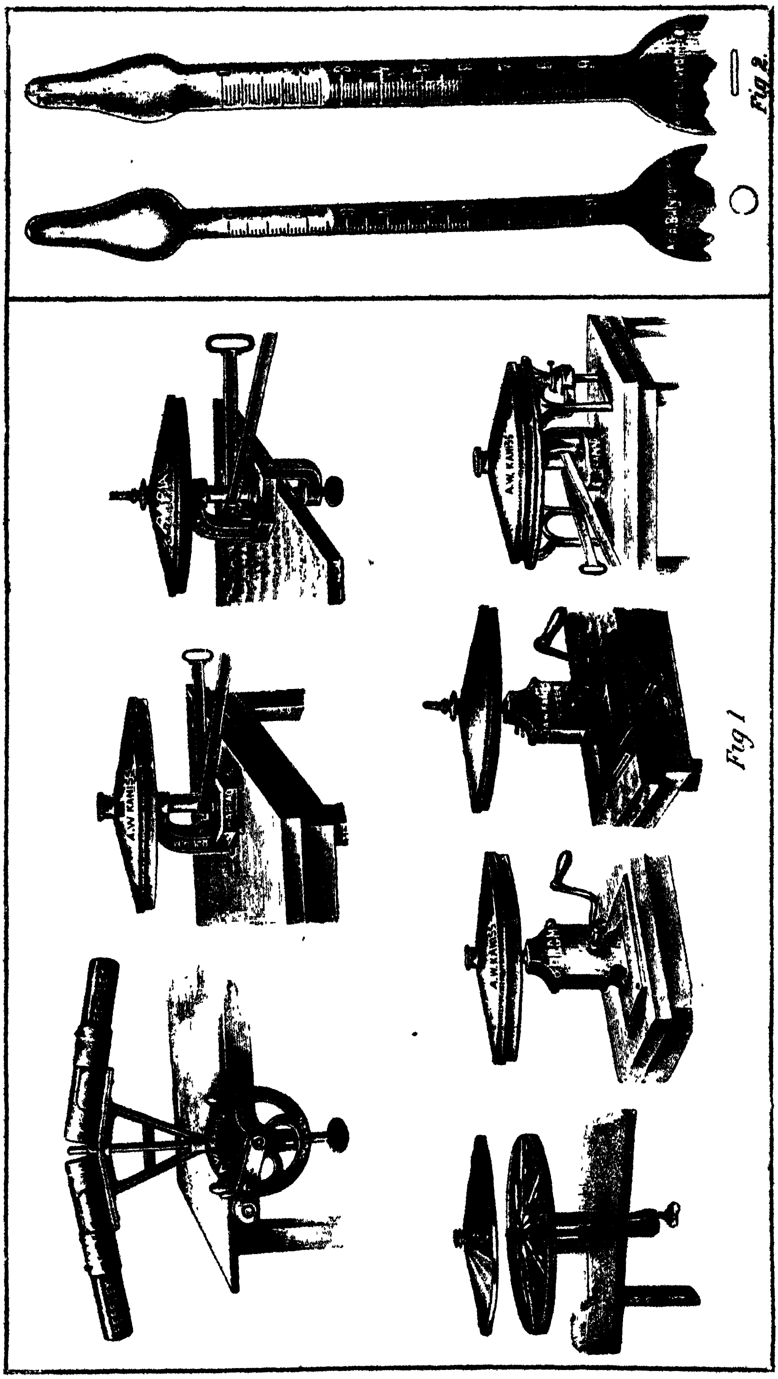


Plate 40.

Fig 1

Fig 2.

Separators.

Fig. 1. The Gerber Test—some types of Separators used.   Fig. 2. Test Bottles.

It may happen that milk containing no germs exerting an adverse influence on the quality of the milk itself, yet harbours germs injurious to health by causing diseases such as typhoid, tuberculosis, etc. I do not know of instruments which enable the milk dealer to detect such germs, but he can render such milk practically harmless by sterilisation. This is heating under pressure till over the poiling point.

Plate 41, fig. 2, shows two instruments for heating milk in bottles till over the boiling point by steam pressure. An objection to sterilisation is that the digestibility of milk suffers, and that some bottles may break during heating.

The picture shows bottles with the old-fashioned system of closing, which, as I pointed out, could with advantage be replaced by a new method.

To prevent the infection of milk with noxious germs it is desirable to place the milch cattle under the continuous supervision of a veterinary surgeon. In a circular on milk treatment I pointed out in rules what measures can be taken to get pure hygienic milk. It seems superfluous to repeat that here. A recent invention is the use of paper bags strong enough to serve as milk bottles. After use the "paper bottles" are thrown away. I have not yet seen this applied, and therefore cannot say whether the invention is practical. The arrangement will, however, prevent the defilement of milk by insufficiently cleaned bottles.

In households where no ice-chest is available, milk can be placed in a cool, dark room in a pail with cold water. This water should be renewed occasionally. In this way souring of milk on warm days is retarded. Another effective method is to wrap the milk bottle or can in a cloth and place it in a shallow pan with water. The cloth absorbs the moisture, which evaporates slowly. For evaporation heat is required, and this heat is withdrawn partly from the ambient air, partly from the can. Consequently, the can will be cooled so long as the cloth is kept damp.

To make quite sure that milk contains no living noxious germs, it should be boiled for ten to fifteen minutes. This, however, impairs the digestibility, a point that requires serious attention if the milk is required for infants' food, and the milk assumes the "boiled" flavour, which is unpalatable to many. So-called "sanitary milk" and "infants' milk" should conform to very strict requirements, fixed by law in some countries. About this some other time.

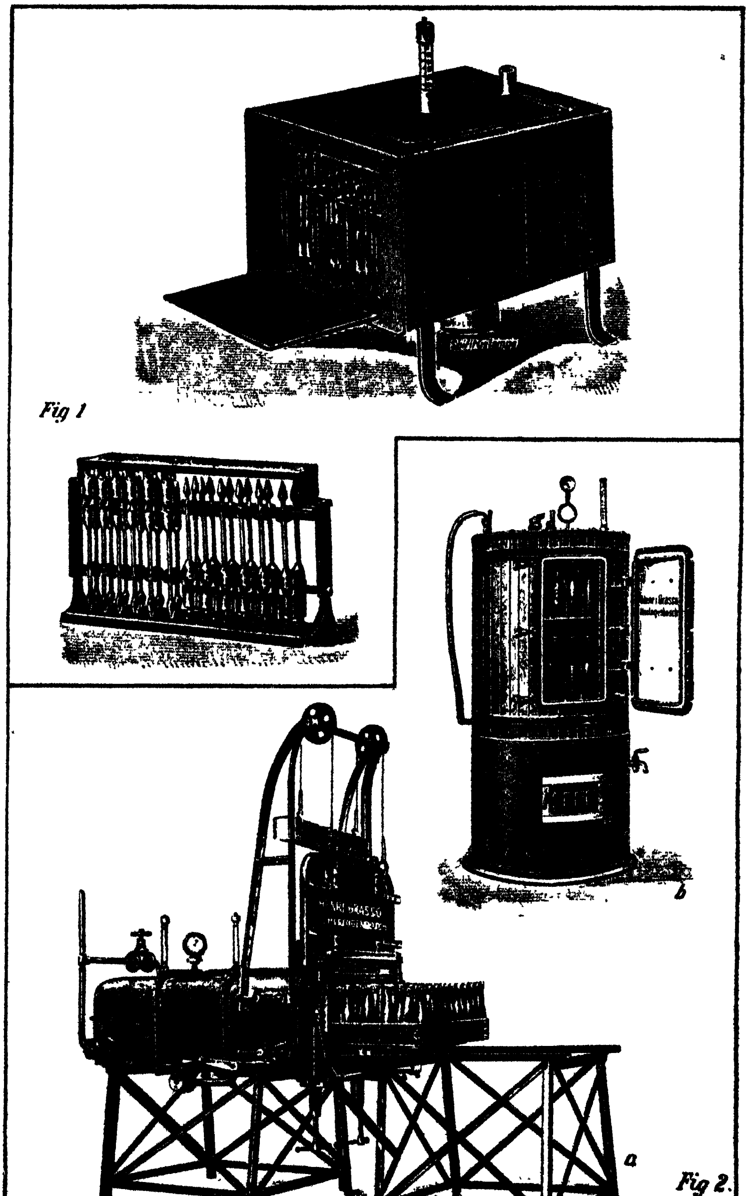


Plate 41.

Fig. 1. Heating Apparatus.

Fig. 2. (*a*) Flaack's Apparatus to sterilise milk in bottles by steam for factories.
(*b*) Sterilising milk in bottles by steam for dairymen.

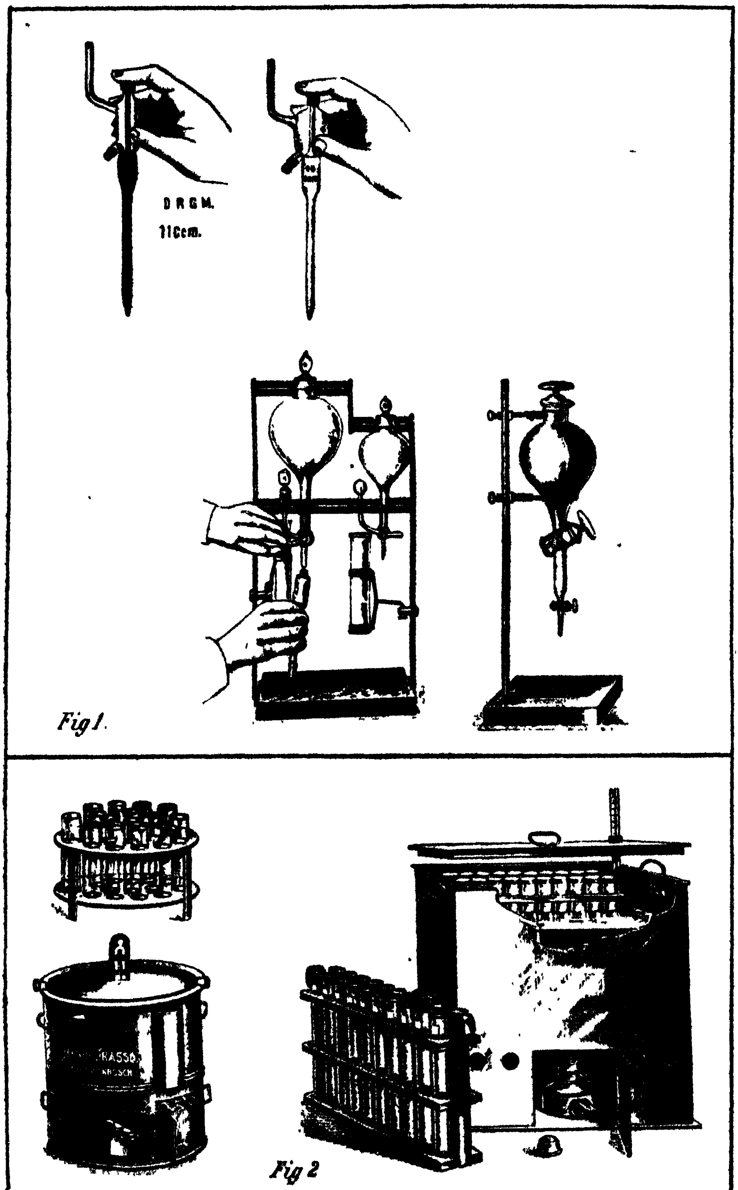


Plate 12. Fig. 1. Automatic Pipets and Measuring Instruments.
Fig. 2. Milk Fermentation Apparatus.

The Tobacco Section.

TOBACCO EXPERIMENT STATIONS.

By J. van Leenhoff, Chief of the Tobacco Division.

I have been unable to prepare a complete technical article for this *Journal*, as I should like to have done, owing to the rapidly increasing amount of work with which the Division has to cope, and also on account of my frequent absence from headquarters during the past few months, travels in and outside the Colony, and paying periodical visits to our Experimental Stations so as to direct the work there. The tobacco season will, however, be in full swing at the time of the appearance of this *Journal*, and I feel, therefore, that I cannot allow such an opportune moment to pass without some comment.

In the first instance I would strongly advise all readers who are interested in the culture of tobacco to pay a visit to our tobacco Experiment Stations at Rustenburg and Barberton during the months of January or February. The officers in charge will be pleased to furnish all particulars regarding the work which is being carried out on their respective stations. The Rustenburg Station is intended for planters from the centre and western part, and the Barberton Station for planters in the eastern part, of the Transvaal.

Both of our tobacco stations are now more or less established, and they are fitted with modern tobacco plantation equipment. In this article will be found a few photographs of the Rustenburg farm and of our last year's experiments at Pretoria. I have two objects in including these plates: First, to show our planters that useful knowledge is to be acquired by paying a visit either to Rustenburg or Barberton; and, secondly, in the hope that our planters will emulate our methods as far as possible on their own farms.

Where our Rustenburg Station stands was bare veld only eighteen months ago, and it will be seen how much progress has been made since that time. On account of the size of the farm (a large plot being needed for the erection of buildings, grazing grounds, etc.), some people were afraid that it was our intention to compete with them, whilst others were of opinion that there was nothing further to be learnt with regard to tobacco culture.

Such views have undoubtedly changed, and it can now be safely said that all progressive tobacco planters are convinced of the beneficial results attending this experimental work, namely, the establishing the production of a good marketable bright leaf (for which there is such a good demand); raising the best seed for that purpose, and the facilities which are given to learn how to produce it with judicious fertilising of the soil; treatment of tobacco in the field, and modern methods of curing. Most of the progressive farmers have already applied several of these methods on their own farms, and it is gratifying to note that large companies, as, for instance, the African

Industrials, Ltd., and Hartley & Sons, are now conducting their plantations on our principles.

I am personally indebted to the following gentlemen:—Louis Jacobsz, Esq., M.L.A.; B. I. J. van Heerden, Esq., M.L.A.; P. Grobler, Esq.; A. R. Orsmond, Esq., Resident Magistrate, Rustenburg; and other influential gentlemen who have all along given us their support which, in a great measure, has helped to make our tobacco work popular amongst the planters. But, perhaps the greatest impetus to our work has been the support we have received from the progressive tobacco planters themselves, for they have come to our assistance in as much as they have interested themselves in the work of the Division, and have all informed their neighbours more or less of what they have seen and heard from us. In this connection I would like to record my appreciation to the following gentlemen:—Combrink Bros., Waterval; Van der Westhuizen Bros., and Alb. Gornitska, Esq.. Arnoldistad; Geo. Ottermann, Esq., and Theod. Wenholt, Esq., at Kroondal; Jansen van Rensburg, Esq., Sterkstroom; Kirsten Bros., Boschhoek; W. Robinson, Esq., Olifantshoek, and many others who have visited our farms and tobacco-rooms at Pretoria, and have been in constant touch with us, and are taking great interest in our work. This will, I hope, also induce other farmers to show some interest, and to come to us for information and advice when necessary.

It is intended that our farms should be worked as far as possible by farmers' sons whom we are taking as working pupils at a small remuneration. (See foot-note.)

It is gratifying to note that the number of applications for these posts exceed the number of vacancies we are able to offer during this our first year's work. The pupils are chosen, as far as possible, from various localities, so that when they return home the knowledge they have acquired will be distributed throughout the country.

I am pleased to be able to say that the pupils show a remarkable interest in the work.

Let us now turn to the photos themselves.

Plate 43, Fig. 1, shows the water reservoir or dam which was constructed by our own staff. The water is pumped by a windmill from a small river (Dorpsriver). Although the soil is rather sandy, and, consequently, easily drained, it is, however, thought that we shall have a sufficient supply of water for irrigating, as the soil is properly prepared and the principle of proper cultivation practised as explained in previous articles. There is a tendency amongst planters in the Transvaal to over-irrigate tobacco lands, and this has a bad effect on the quality and quantity of the leaf. To visitors in January I would draw special attention to the good growth of our tobacco plants; they received practically no irrigation except once immediately after transplanting.

Plate 43, Fig. 2.—After harvesting the tobacco the soil should receive a good deep ploughing. For this purpose, at Rustenburg, we have a German make (Rud Sack) plough with which it is possible to plough 18 inches deep, if necessary. The plough in this photo,

NOTE. The Right Honourable the Minister of Agriculture has taken personal interest in extending facilities to working pupils.

however, is of American make (Blue Bird); it ploughs easily 12 inches deep. Shallow ploughing of tobacco lands is a common error in this Colony; many planters plough only 6 inches deep, and some not so deep as that even.

It is a well-known fact that, with proper ploughing, the texture of the soil and its water-holding capacity is greatly improved, also, the availability of plant-food is hereby greatly increased. The practical advantages accruing thereby are (1) quicker growth, (2) better development of plants, (3) improved burning quality, (4) finer texture, and other desirable improvements which are well worth the consideration of the planters, in fact, enough cannot be said for the advantages of proper and deep ploughing.

Plate 44, Fig. 1.—This shows (1) flue-curing shed, and (2) fuel-shed, which need no further comment here as an account of the subject of flue-curing tobacco and the erection of suitable sheds has been fully described in "Farmers' Bulletin," No. 10, which is to be obtained in English and Dutch, and is issued gratis to every bona fide farmer in the Transvaal. Fig. 2 conveys more or less an idea of the nature of our farm equipment and buildings, with seed beds in the foreground.

Plate 45, Figs. 1 and 2, are good pictures of our seed beds. I have already described in previous articles the proper method of preparing seed beds and the care which should be bestowed upon them. (See Bulletin No. 2.) Visitors to the station were astonished at the remarkably healthy look of these seedlings, and I may say there has been no sign of disease in the beds.

In this country it often happens that great damage is done in seed beds by fungus disease, seed beds being sometimes totally destroyed by the same. A few notes on the manner in which these beds were prepared may, therefore, be interesting.

After the soil had been thoroughly prepared in readiness for the seed, water was boiled on a fire made near the beds in old paraffin tins, and the boiling water was applied on the beds and allowed to soak in to a depth of from 6 inches to 9 inches; the seed was sown the following day after the beds had dried up a little. In some cases the boiling water was twice applied. This method of treating the beds has resulted in our experiencing no trouble from fungus disease or insect plagues notwithstanding that, on some beds, fresh stable manure had been used.

The application of boiling water on the beds seems to practically sterilize the soil, killing all fungus germs and insects which may be present.

It is a much cheaper and simpler method than steaming the beds. It is undoubtedly a much better method than the old-fashioned plan of burning the beds, which only kills the pests which are found on the surface, but boiling water destroys everything for a depth of at least 6 inches. Another evil of burning is that it also destroys the organic matter, which is of enormous use, and which also prevents caking of the soil. To protect the beds from flying insects a covering was used composed of a kind of linen, especially prepared for seed beds, and which is used on the large plantations in the Dutch East Indies.

The construction of the beds is shown very clearly in the photo, so that, I think, needs no further comment. It must, however, be remembered that the bad practice of making beds below the surface of the surrounding ground, which allows water to stand on the beds, is to be condemned. The frame can be made very cheaply, for instance, sun-dried bricks may be used such as shown in the photo. When the rainy season arrives and the bricks commence to crumble away through the rain, the plants will, by that time, be of such a size that no damage will result to them by this. At intervals the beds are sprayed with paris green and bordeaux mixture (see photo), and this is fully described in previous articles. It must be constantly applied (say once every fortnight or oftener, and of a stronger solution if disease is present) until topping time.

Plate 46, Fig. 1.—This is the photograph of our cigar-wrapper tobacco field grown last year near Pretoria. The plate shows how the soil should be kept clean and loose. After the plants have taken root in the field the soil surface between the plants must be kept loose by cultivating with horse-cultivator, or, if the soil is sandy, by hand-cultivator. The lower leaves must be taken off which decreases the danger of mildew and other diseases. The soil should be gradually raised around the stems of the young plants, as shown in the photo, this assisting a better development. Fig. 2 gives us an idea how the priming of the leaf takes place, i.e. harvesting the tobacco leaf by leaf, commencing at the bottom of the plant and working upwards as the leaves ripen.

Plate 47.—This photo also represents our work of last year near Pretoria; the leaf harvested is now being fermented, and will be sent to European markets for report. Local manufacturers are of opinion that the leaf possesses the desired quality of cigar-wrapper tobacco, especially as regards the colour, texture, shape, and elasticity of the leaf. It shows the tobacco in the field shortly before harvesting time (season 1907-08). This season was exceptionally dry, and, although only one irrigation was applied, we succeeded in obtaining a fairly good crop. Some of the best plants were bagged (see photo) and left for seed production.

THE CHARACTER OF THE NICOTIANAE AND THEIR CLASSIFICATION.

By J. van Leenhoff, Chief of Tobacco Division.

When speaking of tobacco, or of the tobacco plant, few of us realise the large number of different species and varieties of the plant which are grouped under this heading. The botanical name for the tobacco plant is Nicotiana, belonging to the Solanae group.

In many different parts of the world all the various species and varieties are grown. They comprise a very varied collection, some well known, whilst others, I daresay, are unknown in the Transvaal. It will, therefore, no doubt be interesting to us all, and especially to the intelligent tobacco-grower, to have some idea of the

characteristics which some of the species possess and by which they can be identified.

Professor O. Comes, Director of the Royal Tobacco Experimental Station at Scafati, Italy—a well-known authority on such matters—has made a special study of the grouping of all the species of nicotiana.* He groups them under three scetions, viz.:—

(a) Nicotiana tabacum.
(b) Nicotiana rustica.
(c) Nicotiana petunoides.

To the *first section* belong the tobaccos with bell-shaped flowers, more or less intensely red and the leaves sessile (except the fruticosa).

To the *second section* belong the tobaccos with jug-shaped flowers, dirty yellow, and leaves petiolated.

To the *third section* those with white flowers having long calix and hippocratary† formed corolla.

In the Transvaal we need only, for the present at all events, interest ourselves in section Nicotiana tabacum.

(a) NICOTIANA TABACUM.

The varieties belonging to the Nicotiana tabacum are six:—

First group:	Nicotiana	tabacum,	variety	Fruticosa.
	,,	,,	,,	Lancifolia.
	,,	,,	,,	Virginica.
Second group:	,,	,,	,,	Brasiliensis.
	,,	,,	,,	Havanensis.
	,,	,,	,,	Macrophylla.

These six varieties, as has been seen, are divided into two groups.

To the *first group* belong the varieties with lobes of the corolla longer than broad, veins of the leaves acute angular.

To the *second group* the varieties with lobes broader than long, and bearing leaves which show secondary veins more or less rectangular to the mid-rib.

The first group then has strong tobaccos on account of an excess of nicotine.

The second group has aromatic and sweet tobaccos.

Nicotiana tabacum, variety Fruticosa.

Lobe of the corolla triangular, longer than broad. Leaf stalked, with little developed ears at the base. Leaf oval, acuminated, undulated at the base; veins sharp on the mid-rib.

Genuine variety: Fruticosa.

Nicotiana tabacum, variety Lancifolia.

Lobe of the corolla very long, triangular, tube long.

Leaf sessile, long and narrow.

Veins sharp on mid-rib. Upper leaves linear, much undulated at the margin.

* I am greatly indebted to Miss Leendertz, Botanist of this Department for her translation of botanical names and expressions.

†Sleeve-shaped.

Nicotiana tabacum, variety Virginica.

Flower with lobe of the corolla longer than broad; broad at base and sharpening to a point and twisted towards the tip.

Leaves lancet-shaped, broad at the base, having small flap (or wing); ears narrow; veins sharp on mid-rib.

Genuine variety: Virginica.

Nicotiana tabacum, variety Brasiliensis.

Lobe of the corolla broader than it is long—bow with pointed quarters (characteristic).

Leaf sessile, of which upper and under sides are different; contracted at the apex; ears large: veinlets chiefly at the base, nearly rectangular to the stem.

Nicotiana tabacum, variety Havanensis

Lobe of the corolla broader than it is long, shortly contracted to an acute point.

Leaf elliptical, acuminated, with square ears The secondary veins are inserted almost at right angles on the mid-rib. The secondary, tertiary, etc., veins join among each other all near the margin of the leaves like embroidery, this characteristic shows, at first sight, the presence of havannah in a hybrid. It requires, however, much practice to distinguish it.

Genuine variety: Vuelta de Abajo—Deli—Rano—Spanisch—Comstok—Seed Leaf.

Nicotiana tabacum, variety Marcophylla.

Lobe broad and short, so that between one lobe and the next so little space is left to give the whole corolla the shape of a pentagon.

Leaf sessile, of different shapes, with secondary veins inserted at right angle on the mid-rib, and quite opposite at the base, whilst in all the other varieties they stand alternately (distinctive characteristic).

These varieties are also distinguished by their colour and habit. It requires, however, much practice.

(b) NICOTIANA RUSTICA.

Of the rustica we have also six varieties, viz.:—

Nicotiana rustica, variety Texana.
,, ,, ,, Tamaicensis.
,, ,, ,, Brasilia.
,, ,, ,, Asiatica.
,, ,, ,, Humilis.
,, ,, ,, Scabra.

(c) NICOTIANA PETUNOIDES.

Of the petunoides there are a great number of varieties not fit for commercial purposes, and of no importance to us.

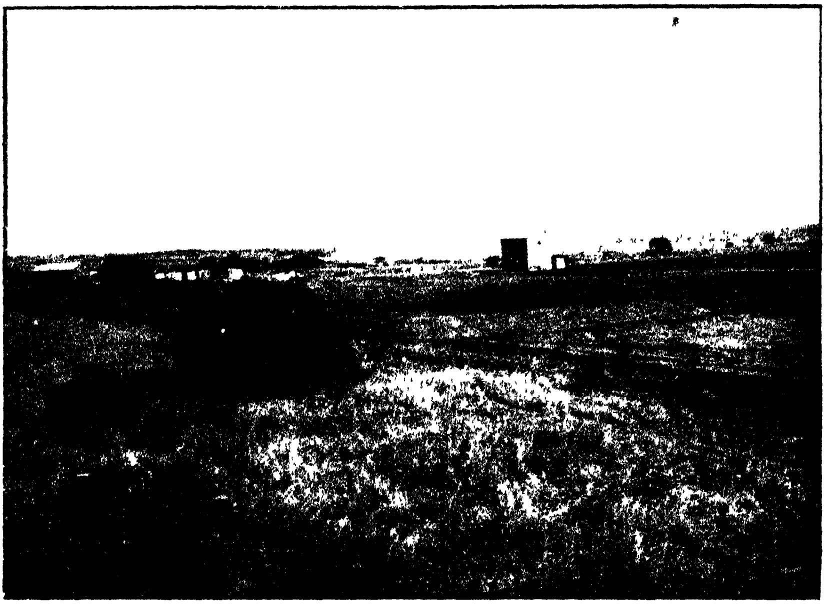


Fig. 1.

Plate 43

Fig. 2

Rustenburg Tobacco Station.

Fig. 1. General view of farm, showing water reservoir and tobacco lands.
Fig. 2. Deep spring ploughing

Fig. 1.

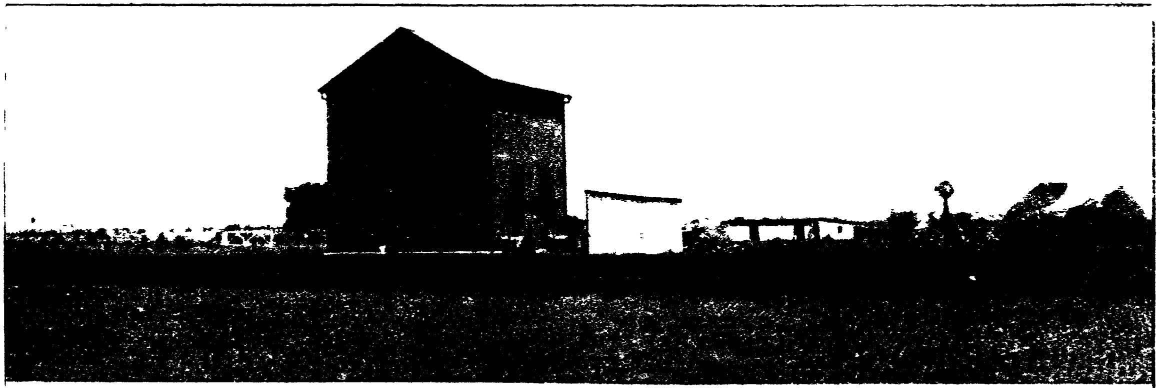


Fig. 2.

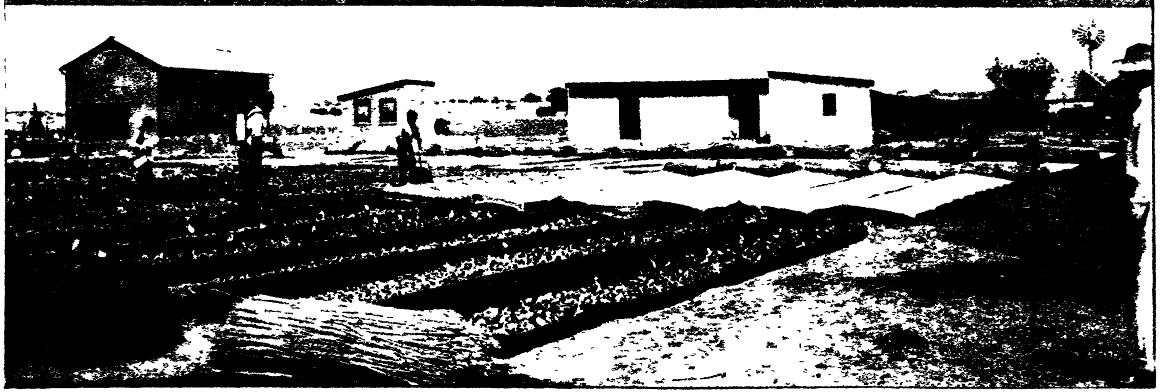


Plate 44.

Rustenburg Tobacco Station.

Fig. 1. Flue-curing shed. Fig. 2. View of buildings, outhouses, and general equipment.

Fig. 1.

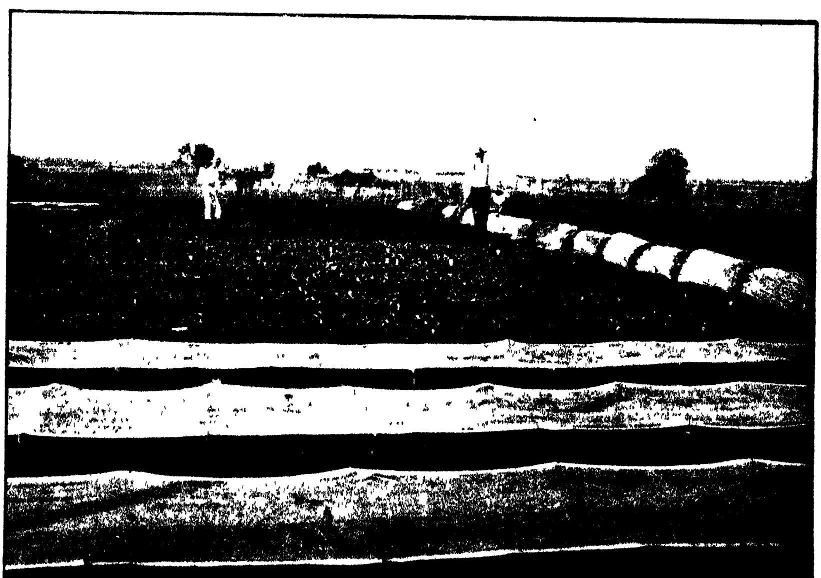


Plate 45 Fig. 2.

Rustenburg Tobacco Station.

Figs. 1 and 2. Tobacco Seed-beds, showing construction of beds, spraying, and watering of seedlings.

Fig. 1.

Plate 46 Fig. 2.

Pretoria Tobacco Experiments, Season 1907-08.

Fig. 1. Field kept cultivated, sand leaves taken off and soil gradually raised.
Fig. 2. Harvesting tobacco by priming (i.e. leaf by leaf).

Plate 47. **Pretoria Tobacco Experiments, Season 1907-08.**

Field of cigar wrapper tobacco under cheese-cloth.

The Fencing Section.

SOME NOTES ON THE NEW FENCING LAW.*

BY E. N. CRESSWELL, Division of Brands and Fencing.

DURING the last session of the Legislative Assembly an Act was passed which will undoubtedly have very far-reaching effects on the agriculture of the Transvaal, viz., the Fencing Act, No. 12 of 1908. This Act is second only in importance to the Land Bank Act of 1907, and is in a sense supplementary thereto. The Transvaal farmer in the old days was somewhat averse to enclosing his farm, chiefly on account of the expense involved and of the fact that owing to the immunity of his stock from disease, the advantages of fencing did not present themselves to him in a forcible manner, but owing to the war and the consequent dissemination of stock diseases of various kinds, it has become increasingly evident that in order to safeguard his stock he must fence his farm.

The progress of a country can be fairly accurately gauged by the extent of the fencing erected, for fencing is a sign of the change from rough and ready methods of stock breeding or agriculture to scientific farming, in a word, from extensive to intensive farming.

By enclosing his holding a farmer is enabled to allow his stock to run in the veld day and night, to their infinite advantage, for, as all farmers will readily admit, the kraaling of stock at night is not a system that conduces to their well-being, in the first place all the stock is brought together within a confined area, the younger animals are constantly being worried by the older ones, and if there should happen to be any diseased animals in the flocks or herds, there is no surer method of disseminating the disease, for instead of the diseased animals going away from the other stock as is usually the case when sick, they are brought in close contact with the healthy ones. Again, fencing materially assists in preventing the illegal trekking of cattle.

By erecting interior fencing and making camps or paddocks, a farmer can greatly increase the carrying capacity of his land, for he can graze one paddock and "rest" another, or if he wishes to go in for veld improvement, he can obviate the danger of the new pasture grass being eaten out before it has become established. Furthermore, by having his lands fenced and his whole farm enclosed the services of herd boys can be dispensed with or utilised in more remunerative work.

It is undoubtedly a fact that fencing is one of the best methods of preventing the spread of disease that we know of. Had the country been fenced in 1896 and 1897 the rinderpest could not have swept down from Egypt through Central Africa to Capetown, devastating the country and leaving distress and ruin in its wake, nor would that dread disease, East Coast Fever, have occasioned one-tenth part of the havoc that has been wrought thereby.

* No. 12 of 1908.

In December, 1903, Dr. Robert Koch, the celebrated authority on stock diseases, predicted that East Coast Fever, or Rhodesian redwater, as it was then erroneously termed, would sweep through the country to the sea. The doctor's opinion was probably based on the fact that the great majority of farms in South Africa were unfenced.

Nothing but the action of the Department of Agriculture in inaugurating its policy of fencing farms infected with the disease, or suspected of being infected, and of making buffer zones between infected and clean districts, and preventing the movements of stock, has saved South Africa from that fate.

Unceasing vigilance is the price to be paid for immunity from the disease, and the Transvaal, Cape Colony, Orange River Colony, and the Bechuanaland Protectorate are all incurring heavy expenditure in the erection and maintenance of border fences and in the payment of special police to patrol the border fences, but if fencing were to become general, practically the whole of this expenditure might be obviated.

Until recently the only fencing undertaken by the Government was that of farms infected with East Coast fever, enclosed under the provisions of Ordinance 38 of 1904. For some time past, however, there has been a growing desire on the part of farmers to obtain material on easy terms and at a low price for the enclosing of their holdings, and this demand the Government has met by passing during the last session Act No. 12 of 1908.

The main provisions of the Act are as follows:—

1. There is absolutely no compulsion upon any farmer to enclose his holding.

2. Material will only be issued to *owners* of farms, or, on certain conditions, to the lessees or licensees of Government farms; but in any case it will only be issued in respect of farms occupied in a beneficial manner by one or more white persons.

3. The fences must be substantial, proof against both small and great stock, must be erected on the boundaries of holdings and gates provided where the fences cross public or private roads.

4. No fence must have less than four wires, and all four-wire fences must be composed entirely of barbed wires. Any fences with more than four strands can be either of barbed wire or plain wire or both.

Specifications have been prepared for six types of fences as follows:—

No. 1.—Standard and dropper fence with wooden straining posts.
No. 2.—Standard and dropper fence with iron straining posts.
No. 3.—All post fence.
No. 4.—Post and dropper fence.
No. 5.—Stone pillar fence.
No. 6.—Ostrich-proof fence.

If any owner desires to adopt any other specification than one of those supplied by the Department, full particulars must be given of such specifications. Owners may supply their own posts, straining posts, stays, and gate posts, if up to specification.

5. Material will only be issued for fences on the boundaries of holdings (dividing fences), but if the Department has material to spare, farmers may purchase it for cash for the making of camps and paddocks, or for the enclosing of "lands."

6. **Material will be issued at cost price, but interest at the rate of 3½ per cent. per annum will be charged upon the value of it from the** date the issue is made, such interest being payable to the Land Bank half-yearly in advance.

7. The value of the fencing is repayable to the Land Bank in equal half-yearly instalments spread over a period of ten years, but as the first instalment is not due until two years after the issue of the material, farmers have actually twelve years in which to repay the loan.

8. As a general rule the owner of a farm will, for the sake of economy, erect the fence himself, and undertake the transport of the material from the railway to the farm, but in special cases the Minister of Agriculture may, if he deems fit, sanction an advance to cover the cost of transport and/or erection, such advance to be added to the cost of the material and to be repaid to the Land Bank in a similar manner. It should, however, be clearly understood that the erection of fences will only be undertaken by the Department in exceptional cases.

9. No person can obtain a loan in respect of fencing already erected.

10. Any officers of the Department have authority to enter upon any holding for the purpose of inspecting fences.

11. If there be undue delay in erecting the fence, or if the material is being misapplied, or if any portion of the fence be out of repair, the Department will serve a notice upon the owner to rectify the cause of complaint, and in default of compliance with the order, may take such steps as are deemed necessary to put the matter in order, and the expense of so doing shall be added to the loan registered against the title-deeds.

12. A holding against which a fencing loan has been registered may be transferred to another person with the consent of all parties interested.

13. Adjoining owners are liable to contribute towards the cost of a fence only when they make beneficial use of it. That is to say "A" can only compel "B" to contribute towards the cost of a fence erected by "A" on the boundary line of the two farms provided "B" makes beneficial use of the fence. If "B" makes beneficial use of the fence erected by "A" on the boundary line between "A" and "B's" farm, then "B" would be liable to pay 8 per cent. per annum on one-half of the value of the fence at the time he uses it, and continue such payment for the period during which he uses the fence, plus one-half of the cost of the repairs, the value of the fence to be determined by the Department; or, as an alternative to the payment of interest, either "A" or "B" may apply to the Department for an equal apportionment of the then value of the fence as between them, and thereafter the Registrar of Deeds shall, upon the written information of the Department as to the apportionment, note the necessary charges in respect of each holding. In addition to paying interest to "A" or having the half value of "A's" fence recorded as a charge against his ("B's") farm, "B" must pay "A" one-half of the cost incurred by him in erecting the fence, the value of such erection being determined by the Department. This section relates to fences erected under this Act and also prior to it, and applies equally to farms adjoining Government lands or town lands. In the former case if a settler on a Government farm uses a fence erected by a private owner, the Government, as owner of the land, must contribute to the cost of erection, maintenance, and present value of the fence, and in the latter case the municipality must contribute on the same basis.

On the other hand in cases where the Government or municipalities have fenced their lands, and farmers make beneficial use of the fence, they must contribute in like manner.

14. Any person, whether under this Act or otherwise, erecting a fence on land covered with bush, may clear the bush for a distance not exceeding five feet on each side of such fence, and may remove any tree standing in the immediate line of such fence; and the cost of such clearing shall be deemed to be part of the cost of erecting the fence.

15. In making any ditch and bank fence dividing one holding from another, the ditch may be made on either holding and the soil taken therefrom may be used towards making the bank on the other holding.

16. If any dividing fence be made of posts and rails, or wire, or palings, the posts shall, as nearly as possible, be placed on the boundary line of the holdings.

17. (1) If, between two or more holdings, a dividing line is formed by a dry watercourse or river (not being of such a nature as to form a natural barrier for stock), or range of hills, outcrops of solid rock, or kopjes, along which it is impracticable or inexpedient to erect a fence, the owners concerned may agree upon a fair give-and-take line as a dividing line to be fenced in accordance with this Act, and in default of such agreement any such owner may apply to the magistrate, who shall cause a fair give-and-take line to be surveyed at the cost of the owners concerned.

(2) Any fair give-and-take line so agreed upon or surveyed shall be deemed to be the boundary line for the purposes of this Act, but shall not otherwise affect the titles to any of such holdings.

18. (1) If any fence erected under Chapter I or otherwise than under Ordinance No. 38 of 1904 has become a dividing fence and is out of repair, the owner on either side thereof shall be liable, in equal proportion, for the cost of repairs: and either owner may serve upon the other a notice requiring him to assist in repairing such fence; and if such other owner shall fail for the space of one week after service of such notice to assist in repairing such fence the first-mentioned owner may himself repair it and recover from the other owner the proportion of the cost due from him.

(2) Notwithstanding anything in sub-section (1) contained, if any such dividing fence, or a portion thereof, be destroyed by accident, either owner may immediately repair the same without notice and may recover from the other owner the proportion of the cost aforesaid, provided that if such destruction be due to the act or default of one of such owners he shall be liable for the whole cost of repair.

(3) If any fence mentioned in this section is in the opinion of the Minister not a stock-proof fence, he may order the owner to make such alterations in such fence as would make it a substantial stock-proof fence; and in default of compliance by the owner with the terms of such order, the Minister may cause such alterations to be made and the cost thereof shall be recoverable from the owner.

19. Any person erecting or repairing any dividing fence shall at all times have access to any property, provided that in the case of cultivated lands, gardens, plantations, etc., the consent of the owner shall first be obtained, and also provided that no damage be done to any fruit or ornamental trees or shrubs.

20. For the purpose of any inspection, valuation, or survey, the Minister or magistrate may give authority in writing to any person to enter upon any land and value and survey, etc., or fell trees, or cut fences should this be necessary, but all damage done shall be repaired, or the amount of the damage paid to the owner. Failing agreement the magistrate shall determine the damage.

21. The maximum penalty for leaving a gate open or unfastened, or, finding it open, neglecting to close it, is, for the first offence £10 or fourteen days' imprisonment, for the second offence £20 or one month, or a month without the option of a fine.

22. Any person damaging a gate or fence and thereafter refusing to give his correct name and address to the owner or lessee of the farm or his agent is liable to a fine of £20 or one month's imprisonment without the option of a fine.

23. The penalty for malicious injury to fences is a fine not exceeding £75 or six months' imprisonment, or six months' imprisonment without the option of a fine, and the convicted person is further liable for the amount of the damage caused by him.

24. Any person accidentally damaging a fence must forthwith repair the same, or if unable to do so, shall compensate the owner for the damage done. The penalty for non-compliance is £10 or fourteen days' imprisonment, and the convicted person is liable for the damage caused.

25. The penalty for misappropriating any money advanced, or for wrongfully disposing of any material issued for the erection or repair of any fence is imprisonment for a period not exceeding two years, and any sums owing for any advance or for material is recoverable plus interest at the rate of 6 per cent.

Forms of application and specifications of the fences may be obtained on application to the Resident Magistrates, Field Cornets, or to the Controller of Fencing, Pretoria.

The Dry-Land Section.

THE CONSERVATION OF SOIL MOISTURE.

By William Macdonald, M.S.Agr., Dry-Land Agronomist.

The most important problem in dry-land farming is unquestionably that which deals with the conservation of soil moisture. Hardly a season passes but we hear of crops which have failed because of lack of rain; and this complaint is, unfortunately, not confined to any one particular district, but is more or less common to all parts of the Transvaal. Moreover, this insufficient supply of moisture is due not so much to a scarcity of rain, but rather to its uneven distribution. The average rainfall for the whole of this Colony last year was 23.63 inches, which is a much larger amount—even after allowing for a reasonable amount of waste—than is needed for the production of ordinary farm crops. The practical question is, therefore, "How can we control and conserve the soil moisture so as to save our crops in time of drought?"

Soil Water.

Now, in order to answer this question, we must first understand how the soil holds its water, and the part it plays in the mystery of plant growth. Nor should we forget that the water-holding capacity of any soil is a most important factor in determining the value of farm lands—a matter which, so far as the writer is aware, has not yet been fully recognised in South Africa. It is also important to consider the way in which moisture may be dissipated or lost. In the first place, water, falling as rain upon a field, may be lost by surface runoff, or by percolation in the case of loose, gravelly soil; or, lastly, by evaporating from the surface of the ground. It is plain, therefore, that if by any means we can lessen this loss of water from the soil a larger and surer crop-yield will follow. All farmers are aware of the vast importance of moisture to the growing crop; but perhaps few realise the enormous amount of water that is needed for even a normal crop. Numerous experiments have shown that from 300 to over 500 tons of water are required on the average to produce one ton of dry vegetable matter. In Wisconsin, King found that a two-ton crop of oat-hay required over 1,000 tons of water per acre, which is equal to about nine inches of rainfall.

Again, the amount of water which a soil can hold depends chiefly upon the depth of the soil reservoir and the fineness of the soil particles. That is to say, deep ploughing and the thorough pulverizing of the soil are the two factors which enable any soil to hold the maximum amount of moisture. Most farmers in the Transvaal are well aware of the advantages of deep ploughing, more particularly in dry seasons; but some do not yet fully comprehend the benefit of fining or pulverizing the soil. Now, since each individual soil grain is more or less surrounded by a film of moisture, as will be seen hereafter, it is evident that, other things being equal, the largest aggregate area

of earth grains will retain the most water per cubic foot. Let us make this plain by a simple sum. Suppose that a cubic foot of marbles one inch in diameter has a total surface of 27.7 square feet. Now, for the sake of argument, reduce these marbles to one-thousandth of an inch in diameter, and you will find that the total area per cubic foot is increased to 37,700 square feet. From this little problem it is clear that the total amount of water capable of being absorbed by a soil which is cloddy and lumpy must be very small in comparison to that in a finely divided state, and not only is the absorbing power of the soil much less, but its capacity for holding moisture is likewise greatly diminished.

Free Water or Well Water.

It is well known that all fertile soils contain many tons of water, which is usually present in three forms as (*a*) free water or well water, (*b*) film water or capillary water, and (*c*) hygroscopic water or water vapour. Let us now see what these terms really mean. Free water is frequently called well water, ground water, standing water, or first water. It comes to the surface in the form of springs, and is usually the source of the supply of wells. If you dig a hole in any ground, you will generally strike water at a certain depth, which may be several inches or many feet below the surface. This point is termed the "water-table." Now the surface of the water-table follows, roughly, the general contour of the land, viz., it stands highest where the ground is highest, and lowest where the land is low. In digging wells, therefore, the farmer must take care to sink the bottom of his well so far below the level of the water-table that seasonable changes will not cause it to go dry. As a recent authority remarks, "We must consider, then, that beneath all farm soils, at some depth, there is standing water, and that we plough and harrow above subterranean lakes." This is a most important fact, because if it is only a matter of one or two feet from the surface of the land to the level of the so-called soil-lake, there is evidently not enough dry soil for the plants to grow and thrive in, and, consequently, they are liable to sicken and die off. The depth of standing water most favourable to crops cannot be definitely stated, since so much depends upon the nature of the soil and the roots of the crop. Thus, whilst lucerne needs a fairly large amount of water to do well, its deep rooting habit renders it undesirable that the "first," or standing water, should be as near as three feet from the surface of the soil, whereas the shallower rooting cereals may be successfully grown with a water-level of this depth. Tap-rooted plants descend to an extraordinary depth in sandy loams, and for such crops a high permanent water-level is not good, since they can obtain their moisture supply at great depths and demand a feeding area vast in comparison with the soil mass at the service of shallow-rooted herbs. Thus lucerne roots frequently penetrate to the depth of twenty feet, and double this distance is not unknown.

Film Water or Capillary Water.

But the most valuable water in the soil and, at the same time, the most important for the dry-land farmer, is that which surrounds the soil grains in the form of moisture films, and which is also known under the name of capillary water. It is this water which is absorbed

by the roots of the plants, and, consequently, forms the direct source of supply of all cultivated crops. If you take a pebble and dip it into a basin of water or into the brook, you will observe a film of water closely sticking to the surface of the stone. This is an illustration of what is termed "surface tension," by means of which water, in the form of moisture films, is held in the pores of the soil particles. The existence of this physical force may be made clear by the simple experiment of floating a carefully laid clean needle on the surface of water, or by the fact that a drop of any liquid tends to assume the smallest possible space—that is, the shape of a sphere. In short, the free surface of any liquid tends to become a sort of stretched elastic film under molecular attraction; and this is what happens to the soil films under the action of surface tension.

Now, if very fine capillary (from the Latin word meaning a hair) glass tubes are dipped into water, the water will rise up the tubes in inverse proportion to their diameters, or, in other words, the smaller and thinner the tubes the higher will the liquid rise. Again, if the bottom of a tube containing soil is placed in contact with water the moisture will be drawn up one. two, three, or even more feet, depending upon the nature and the fineness of the soil. The movement of film water is usually referred to as "capillary action," and it was formerly supposed that this moisture passed upwards to the surface by means of capillary or hairlike tubes. In reality, there are no such tubes, merely fine passages, pores, or capillary channels, and the film water rises from the sub-soil by means of surface tension. Thus, when the sun is hot, or a drying wind scorches the ground, the soil moisture rises—as oil is drawn up to feed the flame of a lamp-wick—from the water-table below, which may be two, six, or twenty feet beneath the surface of the ground, viz., wherever free or standing water is found. Hall mentions the steady rise of capillary moisture through 200 feet of fine-grained chalk during a dry season in the south of England.

Furthermore, capillary action depends on the fineness of the soil particles and their closeness to each other. In coarse, loose, sandy, or gravelly soils the action is weak; in fine, well-compacted soils it is strong. Thus in the conservation of soil moisture capillarity is a matter of the utmost importance; and, accordingly, in selecting a farm or a portion of a farm for dry-land crops, this problem should be most carefully considered. Most farmers are aware that in a severe drought it is always the crops on gravels and coarse sands, having a poor lifting power, which suffer first, since the sub-soil water is with difficulty drawn up to the roots of the plant. Should the drought continue, the clay soils suffer next, for, although they may start with a much larger supply of soil moisture, yet the water moves very slowly through the very fine pore spaces, and the upward lift cannot keep pace with the loss at the surface due to transpiration* and evaporation.

As Hall† remarks, and the writer's experience bears out this statement, "The soils which are least affected by drought are the deep loamy sands of very uniform texture, fine-grained enough to possess a considerable lifting surface, and yet not too fine to interfere

* Evaporation of water from the leaves and stems of plants.

† "The Soil." by A. D. Hall, page 95.

Fig. 1.

Plate 48. Fig. 2.

Dry-Land Farming at the Government Stud Farm, Standerton.

Fig. 1. Forming the soil mulch—rolling and harrowing.
Fig. 2. Harrowing to form the soil mulch (the handkerchief is lying on moist soil).

Plate 49. **Destroying the Mealie Grub** (*Sesamia fusca*).

by burning old maize stalks, on the Government Stud Farm, Standerton.

Plate 50. **Dry-Land Lucerne at Vereeniging**

Looking for nodules (containing the nitrogen-fixing germs) on the roots of lucerne

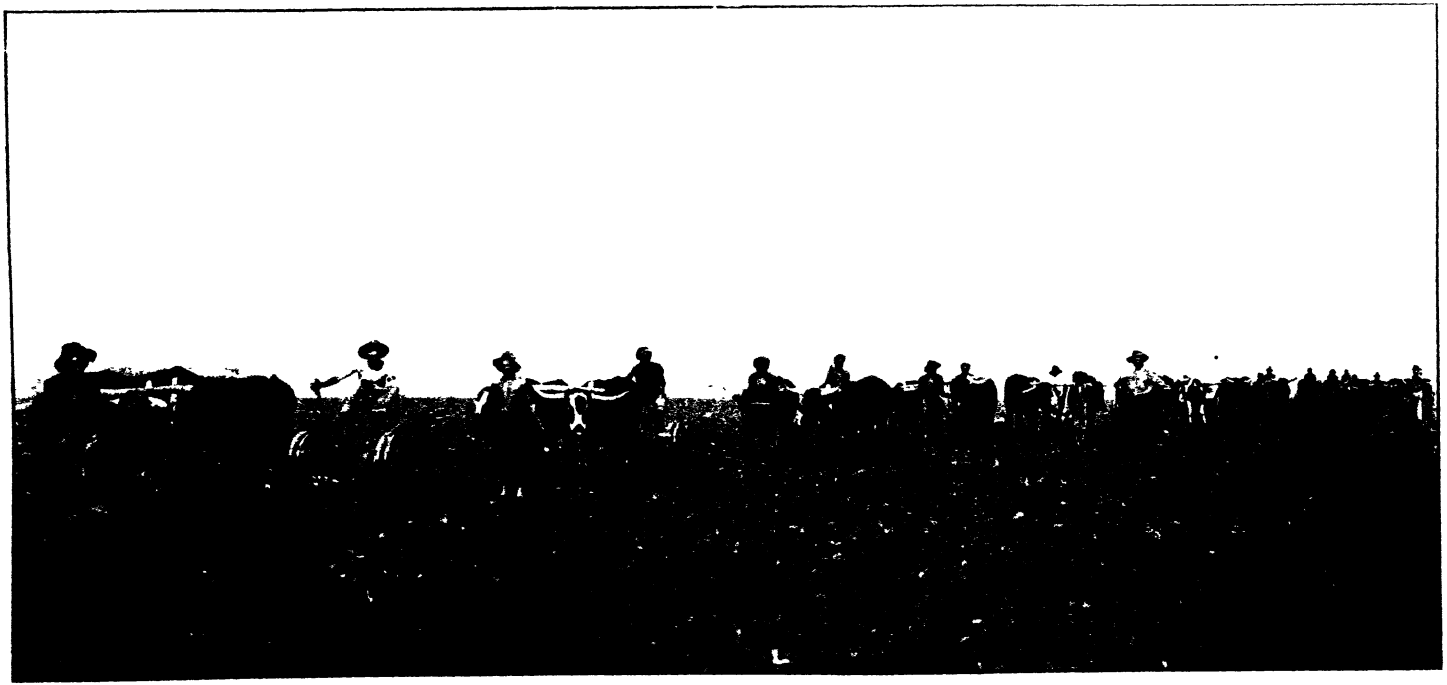


Plate 51.

Dry-Land Farming at Vereeniging.

Planting maize (mealies) with twelve machines, seeding 120 acres per day.

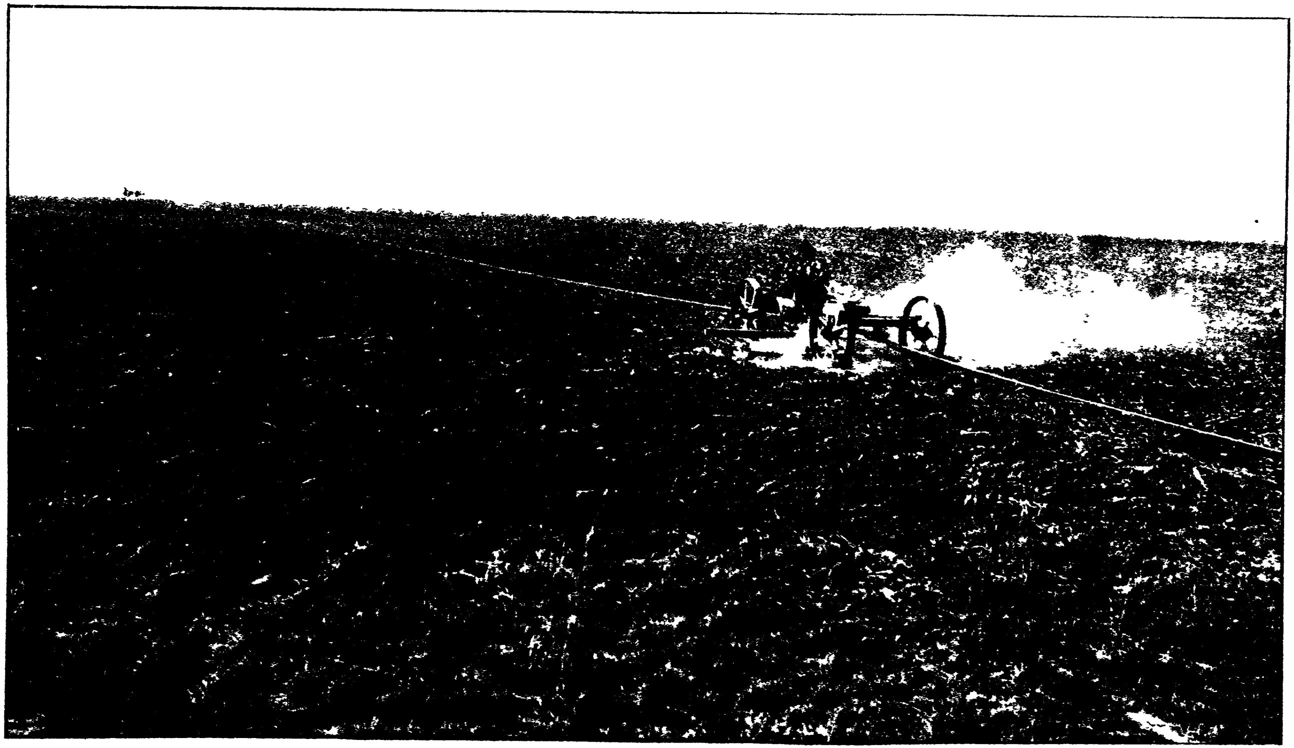


Plate 52.

Dry-Land Farming at Vereeniging.

Two sets of harrows doing 180 acres per day.

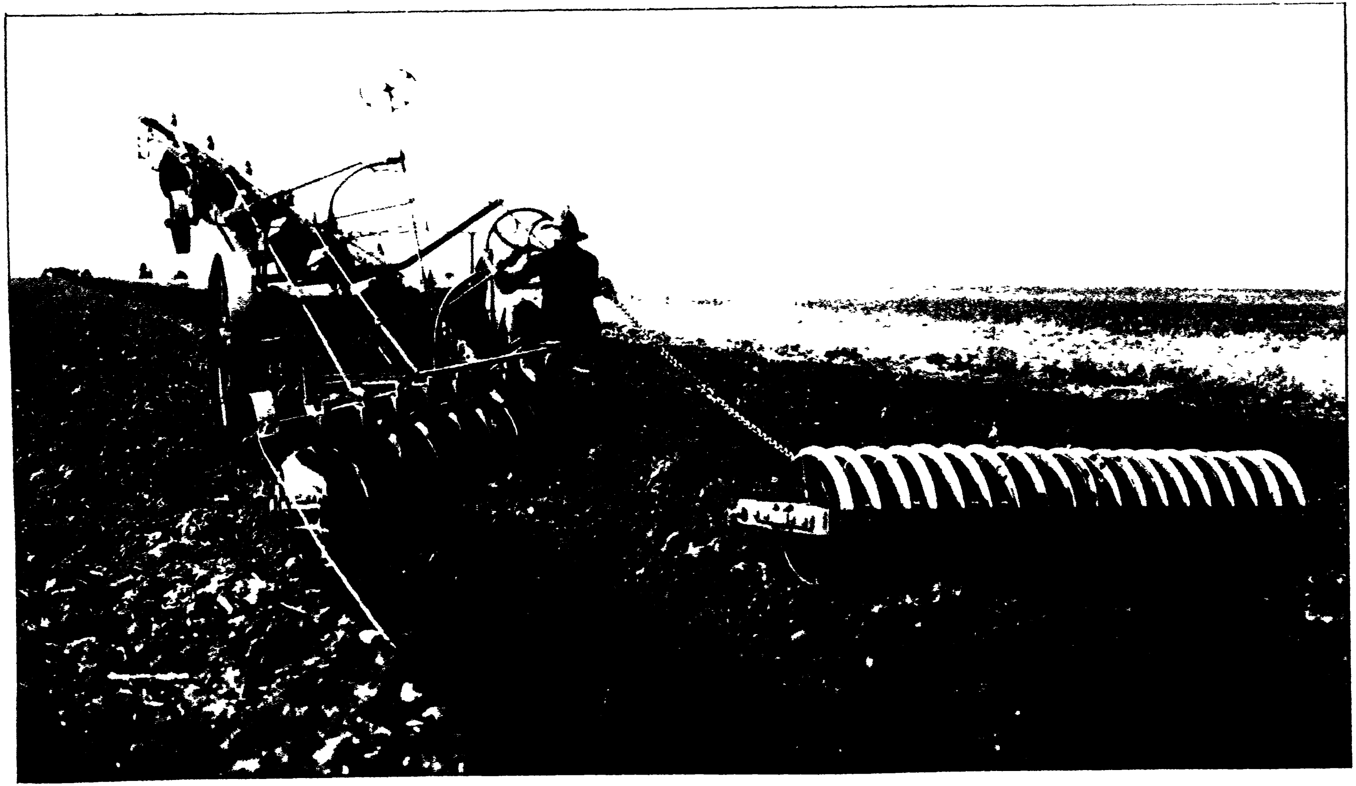


Plate 53

Dry-Land Farming at Vereeniging.

Steam Cultivation. Preparing fallow lands with 7 disc plough and roller.

with the free movement of soil water. The western soils which American writers describe as capable of withstanding an unbroken summer drought of three months' duration are deep, fine-grained, and uniform, with practically no particles of the clay order of magnitude to check the upward lift by capillarity." In the Transvaal, in many districts a most casual examination will reveal two types of soil from an agricultural standpoint. The one may be characterised as a shallow, sandy soil, one to three feet in depth, resting upon a gravel sub-soil; while the other is a deep uniform loam from ten to thirty feet in depth. It need hardly be said that the second soil—the deep loam—will remain practically unaffected in dry weather, whilst plants on the shallow soil are wilting, parched, and dying. But the extraordinary thing is that intelligent men will buy farms without the faintest conception of the nature and quality of the sub-soil—a matter which can be readily ascertained, in a few hours, or a day or two at most, by examining cuttings, wells, railroad embankments, digging pits here and there, or by boring with a simple post-hole auger, as well as by taking stock of the growth and depth of the root-system of native trees and shrubs, grasses, legumes, etc.

For the dry-land farmer in the Transvaal, the best "agricultural bank" is surely his depth of soil. And it cannot be too strongly stated that all farmers should make themselves thoroughly acquainted with the character of their soil down to the depth of at least four, but preferably six to eight, feet. The wisest agricultural chemist in the United States to-day, Professor Hilgard, remarks "that it is hardly excusable that a business man calling himself a farmer should omit the most elementary precaution of examining his sub-soil before planting an orchard or a vineyard, and should at the end of five years find his trees a dead loss in consequence of an unsuitable sub-soil." Again Hilgard says "Eastern emigrants, as well as a large proportion of Californian farmers, do not realise the privileges they possess in having a triple or quadruple acreage of arable soil under their feet, over and above the area for which their title-deeds call."

Hygroscopic Moisture or Water Vapour.

We now come to the third way in which water may occur in a soil. This is as water vapour or hygroscopic moisture, a term which is derived from the Greek word meaning wet. If you take a tumbler of cold water into a warm room the glass becomes coated with a thin film of hygroscopic moisture produced by condensation. Again, the surface soil absorbs water vapour from the air, and more especially during heavy dews and mists or in cool, damp nights. Thus it is that in some parts of the world—notably California and Chili—summer fogs have a markedly good effect upon vegetation. And although this moisture is of but little value save in times of severe drought, it is not to be despised by any means. During the hot days of summer a soil of a high absorptive power, such as a well-tilled clay loam, will retain its moisture for a much longer time than a soil of low absorptive power, such as a shallow sandy soil, whose store of moisture will be exhausted in a few hours, while the surface of the land itself is heated up to the scalding point, thereby searing the stems and root-crowns of the growing crop. It is also worthy of note that, generally speaking, soils of high absorptive power are also those of high capillary power.

Hilgard summarises hygroscopic moisture as follows:—

1. Soils of high hygroscopic moisture can withdraw from moist air enough moisture to be of material help in *sustaining* the life of vegetation in rainless summers or in time of drought. It cannot, however, maintain normal growth, save in the case of some desert plants.

2. High moisture absorption prevents the rapid and undue heating of the surface soil to the danger point, and thus often saves crops that are lost in soils of low hygroscopic power.

The Soil Mulch.

Having spoken of the various ways in which moisture may exist in the soil, we now come to a discussion of the best means of conserving this moisture. This can best be done by what is commonly known as mulching. Any material which is spread upon the soil to shade the surface from the sun and to break the connection between the water-bearing sub-soil and the exposed evaporating surface, is termed a mulch. In gardening operations leaves, manure, coarse hay, straw, grass clippings, etc., are commonly used. Such mulches of loose organic material are very effective—even more so than a mulch of fine earth—but they hinder the continual stirring of the land, which promotes aeration and nitrification.* Stones serve practically the same purpose as a mulch, if they happen to be spread thickly upon the surface of the ground, as they shield the land from evaporation and so tend to keep the soil cool and moist. In the bleak, wind-swept County of Caithness, in the far north of Scotland, the writer has known of cases in which the removal of the numerous small pieces of slate and stone—which are often found on the arable lands of that region—has caused a marked decrease in the crop of the ensuing season. Everywhere you may see homely examples of the principle of mulching. Turn over a board or stone lying on the ground; the soil beneath is more moist than the ground near by—for the pores of the earth have been closed, and the current of moisture passing upward has been stopped. That is why fisher lads look for earthworms beneath stones when the weather is dry.

But the most useful and practical mulch in dry-land farming is that which is made of loose dry soil. This is done by stirring the surface of the soil with any implement of tillage such as the plough, the harrow, or the cultivator. Now in closely packed soil capillary water moves freely, and as the surface layer dries under the action of the sun and the wind, fresh supplies of water are lifted from the sub-soil by surface tension, with the result that there is a steady rise of sub-soil water to the exposed and rapidly evaporating surface. In a word, we may think of the sun and the wind as a mighty double-acting force-pump. An American experimenter found that each square foot of an ordinary farm soil during the summer months lost 1.3 lbs. of water daily by evaporation from the surface of the land or, in other words, over five inches in a single month. But should the top layer of soil be broken up and left loose upon the land by cultivation, then there is no longer one continuous film linking the exposed

* Process of changing nitrogen into nitric acid and nitrates.

surface with the sub-soil water; and, consequently, surface tension can only lift the water so far as the film is unbroken, i.e. as far as the unstirred soil extends, and this layer is protected from evaporation by the loose soil above. That is to say, when a soil mulch is formed the capillary channels are broken and the water cannot rise into the loose layer of surface soil which is separated from the firm soil below by large spaces, across which moisture cannot pass. Accordingly, King writes:—"In the conservation of soil moisture by tillage there is no way of developing a mulch more effectively than that which is produced by a tool working in the manner of the plough—to completely remove a layer of soil and lay it down again, bottom up, in a loose, open condition."

In the humid regions of America it has been found that a soil mulch of a depth of three inches is sufficient to conserve the moisture of the soil. But in California, and the semi-arid west, fully twice that depth is necessary for proper protection during the dry, hot season, which sometimes lasts for three to six months at a stretch. This is particularly true of orchard-cultivation in South Africa. For where the cultivation has been shallow—one to three inches—you may frequently observe that the leaves of the trees wilt badly under the hot sun, but recover later on, or during the cool of the night-time, whereas with deep cultivation the trees do not appear to suffer at all, even during the hottest weather. At the same time, in the case of land intended for small grain crops, a three-inch soil mulch is preferable, as otherwise the soil is apt to become too dry close to the surface where the seed germinates, and where the first roots forage for both food and moisture.

SUMMARY.

Summing up, we have seen:—

1. That the first step in conserving moisture is to put the soil in such a condition that it will permit the rain to enter freely, and into a good, deep reservoir.

2. That water exists in the soil as free, capillary, or hygroscopic, but that free water within eighteen inches of the surface is harmful to the growth of cultivated plants, whereas capillary water is the direct source of their supply, and should be conserved by all possible means.

3. That capillary action depends upon the fineness and the closeness of the soil particles. Consequently, in loose, coarse, sandy, or gravelly soils capillary action is weak, whereas in fine and well compacted soils it is strong.

4. That if the capillary pores in the soil are continuous from the moist sub-soil to the surface, the moisture rises rapidly and passes off into the atmosphere by evaporation. When, however, these pores are made larger near the surface, the upward flow of the moisture is arrested. This can be done by light surface cultivation, which produces a *soil mulch*. But as soon as the soil becomes baked or encrusted the capillary connection with the air is renewed, and tillage is again required to re-establish the soil mulch, and so conserve the moisture in the soil.

NOTES ON DRY FARMING.

IN Circular No. 10, United States Department of Agriculture, Bureau of Plant Industry, Mr. William M. Jardine has an interesting note on dry land agriculture in Colorado which runs as follows:—

"In Colorado I visited the dry farm of Mr. E. R. Parsons, located twenty-three miles south-east of Denver. Mr. Parsons is a very intelligent Englishman. He came to this country from the Transvaal, South Africa, where he had considerable experience in dry farming. He has a commercial orchard which was set out in 1895. Mr. Parsons is now independently wealthy, and I am informed that he has made nearly all of his money out of his dry farm. He says that the success obtained in producing crops without irrigation in eastern Colorado will depend on the man.

"Mr. Parsons attributes his success to the thoroughness with which he cultivates his soil. He never ploughs his land less than 9 inches to 12 inches deep, whether it be sod (turf) or otherwise. This is usually done with a hand plough pulled by four large horses. Mr. Parsons does not approve of the disk plough now so commonly used by our dry land farmers. In this respect I heartily agree with him. Sod land especially should be turned over completely in order that the sod may rapidly and fully decay, and, at the same time, serve as a blanket to retain the moisture that has fallen and accumulated in the soil previous to ploughing. This cannot be accomplished with a disk plough. The disk twists and breaks up the sod, leaving it in clods, thus presenting a very loose and uneven surface which permits a free circulation of air and thus favours rapid evaporation of moisture from the ploughed land. On the other hand, where the sod is turned over completely, the moisture is retained during the entire summer, thus enabling the farmer to prepare a favourable seed bed for planting to winter grain—the crop that now predominates in eastern Colorado.

"In this connection I may state that one of the greatest mistakes new settlers are making in breaking up their land on the plains is in the use of the disk plough instead of the moldboard breaking plough. This is probably due to the fact that with the disk plough, which is of somewhat lighter draught, the farmer can plough up his land more easily and more rapidly. The results obtained from this hasty method are, however, fully evident at harvest time. In my judgment the use of the disk plough should be discouraged."

* * * *

Mr. Robert Pape, the Superintendent of Dairying, writes regarding dry farming in Holland:—"To many it will come as a surprise to hear that dry land farming is carried on in a low country like Holland which enjoys an abundant rainfall. But, in many parts, extensive heaths are found which, in their natural state, are very unfertile, the chief vegetation being heather, and, in some places, pines. Yet this same soil will produce very fair crops if a proper water supply be provided.

"In some parts this can be done by irrigation from the rivers, but, in others, no irrigation is possible without spending large sums in boring for water. The rainfall is plentiful enough, but the

distribution of the strata of the soil, notably the deposits of iron ore, is the main cause why a sufficient supply of moisture cannot be retained in the ground. By means of deep ploughing these strata are broken up and mixed, the texture of the soil is improved, and the water-retaining capacity greatly increased.

"An Association called 'De Nederlandsche Heide Maatschappij' (The Netherlands Heath Association) undertakes deep ploughing for those landowners who wish to reclaim unfertile lands. The general procedure after deep ploughing is to sow lupines for a first crop, which are then ploughed under; the next crop is wheat, after which it is customary to plant pine trees, wood being considered a remunerative crop. In some districts the reclaimed lands are given out to poor settlers who, by continuous hard labour, improve the soil and so gradually become the owners of the land they work. In this way many agricultural labourers obtain the chance of ultimately becoming small farmers. In some districts ploughing is done by oxen, but, for real deep ploughing, a steam plough is used which stirs the soil to a depth of about 40 inches. The main difficulty in deep ploughing is the breaking up of the hard banks of iron ore. Stones and boulders are found in the soil, but the ground is considerably less stony than that of the Transvaal."

In "New Canada" the author, Mr. H. A. Kennedy, quotes the Rev. Dr. Gaetz, a resident for twenty years in south-western Alberta, who speaks regarding the potentialities of the dry lands of that part of Canada as follows:—

"I certainly used to think years ago that there were considerable areas of inferior land in south-western Alberta, but of late years I have so frequently been compelled to change my opinion on witnessing the result of cultivation on these same areas that my mental condition may be described as one of chronic optimism regarding almost all the land I once thought inferior. For example, there is a section of country lying between Olds and Calgary that, when driving over in my buckboard years ago, I found scorched as brown as a berry in July and August. I made up my mind that that section of country was a good place for grain-growers to stay away from. And when settlers began to pour in there in the rainy seasons in 1900 and two following years I wasted a good deal of very generous sympathy upon them. I frequently heard it said, 'Wait till the dry years come and you will see these poor fellows pull out.' Well, we have just had a pretty dry summer following a snowless winter, and on my way here last week I saw in some of those very sections some of the grandest wheat fields I ever saw in any part of eastern or western Canada. The only reasonable theory to my mind is that this bald prairie, for centuries tramped by buffalo and annually swept by fire, became so parched and hard that very little moisture ever penetrated the surface; the melting snow and falling rain alike fell quickly down in the low places, forming the sloughs everywhere to be seen in the earlier years. To-day these have almost entirely disappeared, for no other reason that I can conceive than that the wide area of well cultivated soil absorbs the moisture and retains it for the production of the splendid crops that are to be seen there

to-day. I think there is good ground for believing that as these broad and apparently barren plains, which as yet are barely touched by the plough, are more widely and thoroughly cultivated, we shall see results we have not yet dreamed of."

Eminent English and American authorities have advanced the theory that the larger yields of grain in southern Saskatchewan are due to the penetration of the winter frost to great depths, which, on thawing, furnishes a constant supply of moisture to the growing grain. But Dr. F. J. Alway in his "Studies of Soil Moisture in the Great Plains Region," published in the *Journal of Agricultural Science* (Vol. II, Part 4, July, 1908), makes the deliberate statement as the result of his experiments: "The *moisture stored in the sub-soil* during the previous summer, and not the frost of the preceding winter, is the cause of the high yields of wheat and oats in southern Saskatchewan."*

In Bulletin No. 125, Bureau of Plant Industry, United States Department of Agriculture, the following instructive note appears:—

"The culture of the olive without irrigation in a region where the average yearly rainfall is only 9·3 inches is the most highly successful example of dry farming methods applied to a tree crop of which we have any knowledge. It has long passed the experimental stage, having been carried on in southern Tunis, with the methods now in use, for at least fifty years, and having been developed on a vastly more extensive scale in the same region during the early centuries of the Christian Era."

In the pages of this journal we have frequently spoken of the work in dry-land farming at Vereeniging under the management of Mr. W. A. McLaren, the South African representative of Messrs. John Fowler, of Leeds, England. The magnitude of these operations will be clearly seen by reference to Plates Nos. 51, 52, and 53. Last year, a very dry season, Mr. McLaren harvested 20,000 bags of mealies. He finished reaping on 26th August, and started planting next day. The great advantage of steam cultivation in the Transvaal is that the ploughs are practically never idle, working every day in the year, thereby enabling the seed to be planted very early, viz., before the usual spring rains. Mr. McLaren has put 4,500 acres under maize this season.

* In the "Great Plains" region of Saskatchewan the usual plan of farming is one year of fallow to accumulate the rainfall, followed by two years of grain.

The Household Science Section.

THE MEANING AND SCOPE OF HOUSEHOLD SCIENCE.

By Jeanette C. van Duyn.

What is household science? Many people seem to think that household science only refers to cookery. It is not, however, the study of one science, but of many. In a word, it is household management; the art of managing domestic affairs in the best and thriftiest manner. As a subject of education in schools the term is made to cover many matters, such as food and its preparation; clothing, its various kinds, the making and repairing of it; washing; the lighting, warming, ventilation, and sanitation of houses; hygiene —the laws of health, sickness, and nursing.

This short article is written in the hope that it may call attention to the pressing need of doing something in this connection for the daughters of South Africa. For we trust that the day is not far distant when we shall follow in the footsteps of our American and Canadian friends, who have long ago recognised that something had to be done to elevate and simplify the household duties of women by systematic and scientific training; and, more especially, to fit them for their principal business in life, namely, that of home-making.

There are several colleges in South Africa for training and fitting the young men for the positions they have to take in life. Why should not something also be done for the young women? Surely the educational advantages which are considered so essential for our sons should be regarded as equally essential for our daughters. Too often it happens that a woman enters into married life with only a very vague sense of how dinners should be prepared and the house cared for, and with the idea that a knowledge of such matters would come somehow, and by instinct. Such absence of training has, however, more than once resulted in domestic disaster. The management of a home and the care of a family is a business— a profession, and a very complex and difficult one to master. All the wisdom one may have, or can acquire by the most diligent effort, is needed for success to follow; as, not only do the comfort and happiness of a family depend upon proper home management, but also their health and financial prosperity.

In no other sphere has a woman such a wide scope for exercising her artistic taste as in the home. To improve and beautify the home is certainly a worthy object of a woman's care, and a few hours devoted to this subject in the course of a school girl's education would surely bear compound interest in after years. And as we now have the experience of our Canadian friends to guide us, we hope that the golden day is not far distant when household science will be taught in every school in United South Africa.

The girl who has attended a college or seminary and is highly accomplished, will frequently look upon housework as mere

mechanical drudgery. On the other hand, if scientific and practical housekeeping had been included in her college curriculum, she would take a much keener interest in her home work. We cannot educate our girls first and then try to make good housekeepers of them; they should receive their domestic training in conjunction with their school work. The school should make girls helpful at home as well as outside. The home-making trait is strong within most girls, but it needs cultivation; and a visit to some households shows us the importance of having trained home-makers. Some people seem to imagine that women are born housekeepers. Unhappily, this is not so. In most homes we can see that there is much room for improvement in methods of housekeeping and in economy of labour.

There was a time in Canada when housework was confined almost entirely to the ignorant classes, and, as a consequence, the work was regarded as ignoble. But that day is now past, for the women of the Dominion have begun to realise that whatever goes to improve the homes of the people is a real factor in the building up of a great nation. Gladstone has truly said: "Home is the foundation of a country." A woman should be just as proud of being able to make a pound of good butter as of being able to play Beethoven's sonatas, Chopin's nocturnes, or Liszt's rhapsodies on the piano.

Our girls should be taught to feel that all work is noble, if carried out with intelligence and skill, and that the only disgrace is in the manner in which it is performed. We need not let our work degrade us, no matter how servile it may be. Let us hold up the high ideals of thoroughness, system, and order in our curriculum of home-making, and teach our girls that there is art and science in cookery, sweeping, and scrubbing.

How is it that nowadays girls are becoming so dissatisfied with home life, and are ready to do almost anything else—enter a store, or an office, rather than stay at home? The reason is not far to seek. It is the want of scientific training in household science. Take cookery, for example. There are few young people who are not interested in this subject, and, beginning with the comparatively easy and pleasant task of making a cake or a pudding, it should be no hardship to turn to the more difficult branches of the art and learn the "why" of everything. Our aim should be to develop a modest home-maker, rather than a strong-minded, ambitious, self-centred girl, who, too often in the struggle of breadwinning, loses all her womanly qualities, and becomes heart-hardened and self-confident.

. . . .

On Women's Institutes.*

And now a note regarding women's work in Canada. The ever-active and progressive Canadians were, however, not satisfied with having introduced domestic science into their schools, but recognised that there still remained the urgent need and necessity of reaching the housekeepers and farmers' wives. And, with that object in view—to disseminate information as widely as possible—Women's Institutes were organised.

* The writer is indebted, for much valuable information on this subject, to the annual reports of the Women's Institutes of Ontario, published by the Ontario Department of Agriculture.

The first Women's Institute in Canada was started in Ontario in the year 1900, and comprised a membership of one hundred women. It was most surprising how enthusiastically this matter was taken up by the women, and, at the end of May, 1907, no less than eighty-four organisations were reported in active progress, with branches established at about 400 points in that one province alone, having a membership of 10,964.

During the summer months meetings are held in the country, and, in the winter, in the towns. This plan has proved very successful, a month being chosen when it is most convenient for the farmers' wives and daughters to attend. Carefully prepared papers are read at these meetings—an endeavour always being made to have a variety in the programme, and to choose subjects that are seasonable and practical. Such interesting subjects as the following are treated upon: "Bread-making," "Cooking Meats," "Food as Nutriment," "Home and its Influences," "House Wastes," "Household Accounts," "Economy in the Home," "The Duty of the Mother in the Home," "Advantages of the Country Home," etc.

After the different papers, discussions follow, while great benefits are derived from the practical demonstrations given by members as to the various methods of preparing foods, such as the making and serving of salads; preparing vegetables for the table; different ways of cooking meats; preparing of a breakfast, etc. The demonstrator explains, while working, in an interesting way, the nutritive properties and values of each article used. A special feature at these meetings is the question box, which is found very useful in bringing up a variety of subjects for discussion, and in showing different methods of doing everyday work.

The educational part of these meetings cannot be too highly estimated. Women are brought face to face with the practical side of home life; new ideas are received, helpful and excellent suggestions are given, and, consequently, there is more variety and interest in household matters. The social part of these meetings is also doing a great deal for a certain class of women, who are inclined to stay at home too much for their own good, both of mind and body; they go home full of new ideas and pleasant thoughts which enable them to resume more cheerfully the daily routine of life. To show how popular these meetings are, we need only mention that the total attendance during the year ending 31st May, 1907, was 71,154; 3,047 meetings having been held in the Province of Ontario.

These institutes are established not alone for the farmers' wives, but for the town women as well, since they deal with problems that affect the town women as closely as they do the women in the farm home. Town and country women are thus drawn into closer sympathy with each other, while an opportunity is afforded of exchanging thoughts and ideas, and of becoming better acquainted with one another. Above all, women have been taught that housekeeping is not mere drudgery unless they choose to make it so; and whereas, formerly, a woman would acknowledge with reluctance that she does all her own work, she will now announce it with much pride to her friends.

A library is attached to each institute containing various books on such subjects as domestic science, nursing, sanitation, the chemistry of foods, etc.; whilst various magazines are also subscribed for, such as *The American Kitchen Magazine*, *Canadian Good Housekeeping*, *Woman's Farm Journal*, *The Housekeeper*, *Home Science Magazine*, etc.

A convention is held annually at Guelph at which representatives of the various institutes in Ontario attend. At the opening the National Anthem is sung, after which a prayer is offered, the delegates then being addressed and welcomed by the Minister of Agriculture and the Superintendent of Farmers' Institutes. Reports on the progress of the institutes during the past year are handed in, and various papers on interesting domestic subjects read by the delegates, followed by discussions. Here, again, practical demonstrations form one of the main items on the programme.

It may be of interest to quote the following extract from the address of the Hon. John Dryden, then Minister of Agriculture for Ontario, to the delegates at the annual convention at Guelph in the year 1904:—

"The work which you have on hand in connection with the Women's Institutes is a very noble work, and as long as I am Minister of Agriculture I would like to help all I can. How can I help? Just in this way, by helping you to help yourselves. If you have any suggestions do not hesitate to speak to me or to write me. I am not so uppish that I would not listen to it. I am only too glad to do anything in my power to help along both the men and women of the rural districts of Ontario.

"Think of the formation of the first Women's Institute, so short a time since, and then think of how many we have to-day and think of the tremendous influence they are exerting. I tell you the ladies of the Women's Institutes will move the Legislature of this country yet and you won't know how it has been done. It is a good work, and I commend you for being interested in it."

It will thus be seen that the women of Canada had a special friend in the Hon. John Dryden, to whose efforts the organisation of their institutes has been due.

Again, at the annual convention on December 12th and 13th, 1906, the Hon. Nelson Monteith—now Minister of Agriculture—spoke as follows in his opening address:—

"We feel, and I voice the feeling of the Department, that the work of the Women's Institutes is one of the most important efforts for the betterment of agriculture in the Province of Ontario. We feel that the work of this organisation is touching the home life of the people and making for a higher standard of manhood and womanhood in the proper equipment and fitting of our homes. Apparently the work of the Women's Institutes has met with a warm response on the part of the women of the province. The Superintendent of Farmers' Institutes—Mr. Geo. Putnam—tells me that the membership now exceeds 10,000, which, in so short a time since its organisation, speaks volumes for its popularity."

The Macdonald Institute.

Before closing, it may be of special interest to give a brief account of the Macdonald Institute of the Ontario Agricultural College, which is devoted to the training of girls in domestic science,* more especially since so many of our South African lads are pursuing their agricultural studies at this famous college. This magnificent institute was recently donated to the Dominion of Canada by Sir William C. Macdonald, of Montreal, who generously set aside the sum of \$175,000 (£35,000) for this purpose.

There are two well-equipped rooms which are called kitchens or laboratories. The work of these are in charge of teachers who guide the pupils in their work by necessary comments and corrections, with a view to making the course methodical, scientific, and practical. After having had a certain amount of training in the kitchens, the students work in another room called the practice room. In this room there are four tables, at which sixteen girls can work —working largely on their own responsibility. Then there is a small dining-room attached in which they have to set the tables.

When the girls have done the work required of them in the kitchen and practice-room, they are sent, two at a time, to the opposite wing, to take charge of a suite of rooms, consisting of a kitchen, a dining-room (used as a living-room), a small bathroom, and two moderate-sized bedrooms. These two girls are expected to take entire charge of this wing for a week or ten days, one being the housekeeper and the other the assistant. The housekeeper assumes full responsibility in the buying of the food, etc., using her own judgment, as a woman would have to do in a well-regulated and economically managed home. What she does there is the proof of what she learned in the kitchen—to cook the food, set the table, serve the meals, and take care of the house and practice-room. If she uses good judgment in buying, and gives four wholesome, palatable meals for twenty-five cents (1s.), she is considered a success. For it is comparatively easy to keep house and make a fair show if you have everything in a luxuriant way and plenty of everything to cook; but when you go into a house with bare floors, a table, a cook stove, and a few chairs, you will need much greater skill, economy, and patience. It is not every woman who can make a neat, comfortable, and attractive home under such conditions.

Now, in this wing, of which we have spoken, the girl on duty takes full charge, and the lady principal and one of the teachers occupy these rooms, board there, and report from week to week. When the first girl's time is up, the girl who was her assistant takes charge for a similar period with another girl to assist her.

There is a fine room for nature study, to train teachers and others who want instruction and practical training in that line; a room for manual training of teachers and others; also good rooms for sewing, dressmaking, millinery, and laundry work.

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* Various terms for this subject now exist: Domestic Economy, Household Economics, Home Economics, Domestic Science, Household Science.

In his address at the annual convention of the Women's Institutes of Ontario, in the year 1904, Dr. James Mills, then President of the Ontario Agricultural College, spoke as follows:—

"I do not know how it is with the ladies I am addressing, but I know that we of the College have the greatest difficulty in getting women who know anything about laundry work, and especially about the handling of laundry machinery; and this is a matter of some importance, for there are few things that annoy one more than to have clothes spoiled in the laundry—bad washing, bad starching, bad ironing—everything about it bad, and the clothes ruined and unfit for use; so if we can teach our girls to do good laundry work we will do something to save money, increase comfort, and remove causes of annoyance in Canadian homes. If you know all about how washing, rinsing, starching, and ironing should be done, you can take a very commonplace girl and train her in a few weeks. If not you will have endless trouble and most unsatisfactory results. If it is possible, we are going to teach our girls the art of caring for clothes—even flannels. It is not safe to have your flannels washed in the ordinary laundry. You know how it is—they go in two feet long, and they come out one foot. I think all these things go to show that we are moving in the right direction.

"We speak of cooking, laundry work, and general housekeeping as 'Domestic Science,' and dressmaking, general sewing, millinery, and home decoration as 'Domestic Art.' I suppose this is because the scientific side is the more prominent in the former, and the artistic side in the latter. Nevertheless, there is both science and art in cooking, laundry work, and general housekeeping, and both have to be considered in dressmaking, sewing, millinery, and home decoration; but probably the artistic is more prominent in this division than in what is covered by the words 'Domestic Science,' and we are, I believe, justified in naming a thing from its chief function, whether it be the artistic or the scientific.

"We have arranged a two-year course in domestic science and domestic art for teachers. Then, we have a course for young women who do not intend to teach, but who wish to fit themselves for work in the home. This is also two years: one in domestic science and the other in domestic art. We realise that young women cannot look for positions either in the home or elsewhere where their whole time will be devoted to domestic science or their whole time to domestic art, consequently, we have arranged the course so that they will take both the first year and specialise, taking domestic science or domestic art the second year. In addition to the courses already mentioned, we have a three months' course of a more practical nature; in fact it is largely practical. There are three of these courses in the year."

. . . .

Admirable as must be the result of the training urged in the foregoing notes, there is yet another point to which, in conclusion, attention must be drawn. Woman has her duty to the community as well as to her household. The wife, alike with the husband, should take an intelligent interest in events occurring in the world around them. However competent a housewife she may have become, the

woman who aspires to be a real helpmeet to her husband can no longer afford to allow her interest in things to begin in the nursery or kitchen and end at the garden gate. When she realises her influence in, and her duty to, the community, then will the woman who has made a study of domestic science see how much she can and ought to do in assisting the industrial development of the country. She will find time for this as well as for many other things.

It is at this stage she may become of use to the South African National Union. Her studies will have shown the many uses to which the products of a country can be adapted, and the breadth of view acquired in the course of her training will prevent the wholesale condemnation of local productions because of the faults of the few.

National cooking should be one outcome of that wave of national enthusiasm now going over the country, and it is to the student of domestic economy we must look for developments in that direction. Whatever form those developments take means the creation of new uses for local products—the finding of which is one of the aims of the National Union as well as of the Department of Agriculture.

I.—RECIPES FOR THE FARM HOME.

Milk Soup.

Ingredients: 2 lbs. potatoes, 2 leeks or onions, 2 ozs. butter, ¼ oz. salt, pepper, 1 pint milk, 1½ tablespoonfuls crushed tapioca or sago, 1 teaspoonful celery seeds (or three outside leaves of celery).

Wash and peel the potatoes and cut them into slices; also onions or leeks. Put butter in a stewpan, add the vegetables, and cook for five minutes. Then pour on to them two quarts of boiling water, add pepper and salt, and let the whole boil till done to a mash. Pass it through a wire sieve. Return the soup to the saucepan with one pint of milk. When it boils sprinkle in the tapioca or sago and boil till clear. Stir occasionally.

Preparing Vegetables for the Table

In the first place choose good, firm vegetables, then place them in cold water.

Beans.—Cover a pint of shelled beans with just enough water to cover them. Boil until tender, then drain off the water and add a cup of boiling milk, with a little piece of butter, pepper and salt. Allow the beans to simmer in the milk a little while before serving.

Scalloped Onions.—Select six large onions and boil them until tender. Take them up, drain, and separate them. Put a layer of bread or biscuit crumbs in a dish, then a layer of onions, and so on alternately until the dish is filled. Season with pepper and salt and a little butter. Moisten with milk and brown half an hour.

Potatoes.—To boil potatoes well requires more attention than is usually given them. They should be well washed and pared and then left standing in cold water an hour or two. Put them in a pan of

hot water, with salt, cover closely and boil rapidly, using no more water than it takes to cover them. Just before they are done throw in a little cold water, so as to throw the heat into the centre of them. Then drain and set them on the back of the stove, covered with a white cloth. This will allow the steam to escape, and you will have a nice, mealy potato.

Fried Green Tomatoes.—Take some good-sized tomatoes, rub them with a cloth, slice them, and roll them in flour. Have your pan hot, with butter, or nice fresh dripping, then put the tomatoes in to fry. Season with pepper and salt and cook until brown. Serve hot in a covered dish.

Stuffed Baked Cucumbers.—Cut the cucumbers in two lengthwise without peeling, scoop out the seeds, and fill to heaping each half with a highly seasoned bread-crumb mixture, moisten with melted butter and brown in oven. Left-overs of meat may be used in the filling.

Creamed Cabbage.

Ingredients: 1 pint boiled and minced cabbage, ½ pint hot milk, 1 tablespoonful butter, 1 teaspoonful flour, ½ teaspoonful salt, ½ teaspoonful pepper.

Put the cabbage, hot milk, salt, and pepper in a stewpan and on the fire. Beat the butter and flour together until creamy, then stir into the contents of the stewpan. Simmer ten minutes, being careful not to scorch the sauce. Serve very hot.

Pumpkin Croquettes.

Ingredients: Pumpkin, 1 tablespoonful butter, ½ teaspoonful salt, ¼ teaspoonful pepper, yolk of 1 egg.

Bake, boil, or steam the pumpkin, pass through a sieve, add butter, salt, pepper, and yolk of egg. Form into cones, dip into egg and bread crumb, and fry in deep fat. Serve surrounded with slices of fresh cucumber.

New England Pumpkin, or Squash Pie.

Take a pumpkin, or winter squash, cut in pieces, take off the rind and remove the seeds, boil till tender, and rub through a sieve. When cold, add to it milk to make it quite thin, and to each quart of milk add three well-beaten eggs, sugar, cinnamon, and ginger to taste, and a little salt. The quantity of milk depends upon the amount of pumpkin. Bake with an under-crust, which should be baked before adding the pumpkin. These pies require a moderate heat, and must be baked till the centre is firm.

This same mixture may be baked without a crust in a deep pudding dish. Serve either hot or cold.

Date Pudding.

In view of the fact—as several correspondents have kindly pointed out—that the recipe, appearing under this heading in the last issue, was "undated," we herewith duly beg to "date" it:—

Ingredients: *½ lb. dates (stoned and chopped), 3 cups flour, 1 cup bread-crumbs, ½ lb. dripping, 3 eggs, ¾ cup sugar, 1 tablespoonful butter, 1 tablespoonful soda, pinch of salt.*

Mix ingredients well together, and add a little milk if necessary. Put in pudding cloth and boil for three hours. Serve with a sweet sauce.

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Cambridge Pudding.

Ingredients: *1 lb. flour, 1½ pints skimmed milk, 1 egg, 2 ozs. sugar, ½ lb. apples, peeled and sliced.*

Make a smooth batter of the flour, milk, and egg; add the sugar and the apples. Grease a basin, pour in the mixture, tie a floured cloth over the top, and boil for 2 hours. You can use any fruit you like instead of apples.

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Ribbon Cake.

Ingredients: *½ cup butter, 2 cups sugar, yolks 4 eggs, 1 cup milk, 3½ cups sifted flour, 2½ teaspoonfuls baking powder, white 4 eggs, ½ teaspoonful cinnamon, ¼ teaspoonful mace, ¼ teaspoonful nutmeg, ⅓ cup raisins, (seeded and cut in pieces), ⅓ cup figs (finely chopped), 1 tablespoonful golden syrup.*

Mix first seven ingredients in order given. Bake two-thirds of the mixture in two-layer cake pans. To the remainder add spices, fruit, and syrup, and bake in a layer-cake pan. Put layers together with jelly (apple usually being preferred, as it has less flavour), having the dark layer in the centre.

Queen Muffins.

Ingredients: *¼ cup butter, ⅓ cup sugar, 1 egg, ½ cup milk (scant), 1½ cups flour, 2½ teaspoonfuls baking powder.*

Cream butter and sugar, add egg well beaten, sift baking powder with flour, and add to the first mixture, alternating with milk. Bake in gem tins for twenty minutes.

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Feather Cake.

Ingredients: *3 eggs, 3 cups flour, 1 cup butter, 1 cup milk, 1 cup sugar, 1 teaspoonful soda, 2 teaspoonfuls cream of tartar.*

Beat the sugar and butter to a cream, then add the milk with the soda dissolved in it; stir well, and add one cup of flour with cream of tartar mixed in it, then add the beaten yolks of the eggs and rest of flour. Lastly, add the whites of eggs beaten to a stiff froth, and bake an hour or more.

Good Yeast for Bread.

Ingredients: 2 tablespoonfuls flour, 2 tablespoonfuls sugar, 2 tablespoonfuls salt.

Put in a bottle, fill up with hot water, and leave till it works up. When the cork pops off it will be ready for use.

Mebos.

Take soft ripe apricots, lay them in salt water (about 2 ozs. of salt to a quart bottle) for a few hours. Then lay them on a mat to dry in the sun; the next day press them between the hands to flatten and to let the stone come out. The next day repeat the process. At the Cape it generally dries and becomes "mebos" in three or four days in the sun, but, if the weather should be damp, they might be dried in heated rooms or a cool oven. To crystallise the "mebos" lay them in limewater for five minutes till they feel nice and tender: take out, wipe dry on a soft cloth, and rub coarse crystallised white sugar well into each; take 1½ lbs. of sugar to 1 lb. of "mebos." Pack closely with lots of sugar in between, in jars that will cork well. This makes a very nice sweetmeat. The limewater is made by adding two tablespoonfuls of fine lime to a quart of boiling water. This should be mixed well, and, when the lime has drained to the bottom, the clear water may be poured into a bottle, corked, and kept for use.

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Canning Tomatoes Whole.

Select perfect, medium-sized fruit that is not overripe. First peel your tomatoes by pouring hot water over them. Pack the fruit closely—without jamming them—in wide-mouthed glass jars. Don't fill the jars too full. Wrap each jar in a cloth wrung from hot water, and fill it with boiling water. Seal them up tightly, and place in a kettle or other deep receptacle filled with hot water. Cover all closely and let stand until cool. Store away in a cool, dark place.

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To Can Peas.

Can peas immediately after gathering. Shell them and pack them in the cans as tightly as possible without breaking them; add a little salt, then fill the cans overflowing full with cold water, pouring it in until all bubbles have disappeared. Put on rubbers and covers, but do not screw the covers tight. Place the cans in a boiler, bring to a boil, and boil steadily for three hours. Then remove boiler from fire, screw the covers on the cans as tightly as possible and leave in the hot water until cold.

II.—CONTRIBUTORS' COLUMN.

Readers are requested to send in their favourite recipes; and contributions of any kind pertaining to the house will be gladly received. We shall particularly appreciate reliable recipes on home-made soap. Address to Jeanette C. van Duyn, Department of Agriculture, Pretoria.

We desire to thank the contributors of the following recipes:—

CARAMEL PUDDING.

Ingredients: *5 eggs, 1 teacupful sugar, 1½ pints milk, flavouring essence.*

Put the sugar into an enamelled saucepan, with two cupfuls of water. Let it boil till the syrup thickens and is of a rich golden-brown colour. It must be carefully watched, or else it will burn. When done, pour it into a plain tin mould (a small round cake tin will do, if this be deep enough), twist the mould round till the sides are thickly coated with syrup; there should be about half an inch of syrup at the bottom of the mould. Put this aside for a while to cool and set.

Beat up the eggs with a little sugar to sweeten, some flavouring, and the milk. Pour this into the mould, after the caramel has stiffened. Set the mould in a saucepan containing sufficient boiling water to reach to a third of the height of mould. Cover mould with a sheet of paper, put lid on saucepan, and steam gently for an hour. Turn out when done; the top of the sweet will have a rich brown caramel covering.—MRS. J. CHEERE-EMMETT.

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STAMPED MEALIE FRITTERS.

(Breakfast Dish.)

Ingredients: *3 cups cold stamped mealies, 1 cup white flour, 3 eggs (very well beaten).*

Beat smooth the mealies with flour and eggs, add sufficient milk to make a nice batter, and lastly 1 teaspoonful baking powder. Take spoonfuls of the mixture and fry in plenty of boiling fat.—MRS. J. CHEERE-EMMETT.

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SULTANA CAKE.

Ingredients: *¾ lb. flour, ¼ lb. Sultana raisins, ¼ lb. butter, 1 teaspoonful essence of lemon, 6 ozs. sugar, 2 ozs. orange peel, 2 or 3 eggs, 1 teaspoonful baking powder, 1 teacupful milk.*

Wash raisins thoroughly. Rub butter into flour. Add raisins when perfectly dry and then the sugar, and orange peel cut into thin strips, the baking powder, and essence, mixing all well. Beat the eggs and mix them with the milk, and add to the dry ingredients in the basin, which should be just wet like a stiff paste. Pour all into a well-buttered cake tin, and bake for an hour and a half in a moderate oven.—MRS. JAMES POLLOCK.

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SCONES.

Ingredients: *1 lb. flour, 1 tablespoonful butter, 1 large tablespoonful baking powder, milk.*

Rub butter into flour and add baking powder. Mix all together very lightly with a large breakfast cupful of milk. Roll out, cut into small scones, and bake on a tin previously heated. Bake about seven or ten minutes in a very hot oven. The secret of making the scones light is to handle the dough as little as possible, and to put them quickly in a very hot oven.—MRS. JAMES POLLOCK.

Bottled Fruits.

Select wide-mouthed bottles; avoid bottles with pieces chipped out of neck, or with cracks. Learn to discern between a crack and a flaw. A crack reflects from both sides, a flaw from only one side. Wash the bottles well with warm water, and rinse with cold water. Do not turn them up side down, as it clouds them.

The fruit must be perfectly sound, and not bruised. When possible, pick fresh from the tree. Peel carefully with a sharp knife. Wash each piece of fruit and your knife and fingers in clean water as you peel the fruit. Place carefully in bottle as you go along. When the bottle is quite full, give the fruit a final wash, and fill the bottle with fresh water (rain water is best). Fruits may be preserved in either water or syrup.

Syrup is best made from loaf sugar, but almost equally good with crystalized. Use two breakfast cups of sugar to a two-quart bottle. Dissolve the sugar in hot water, strain through muslin into the bottle, fill up to the brim with tepid water, and place the lid on (omitting the rubber ring); fasten the spring down.

Take a large boiler and place a thick cloth, or a layer of straw, in the bottom. Now place your bottles in it, leaving at least ½ inch space between each bottle, fill the boiler up to the necks of bottles with tepid water, and bring to boiling point. Boil from ten to thirty minutes. When the lid is full of bubbles, the fruit is cooked.

Taking the bottles out of boiler, lay them on a cloth, as a cold table would crack them. Be careful to keep out of any draught, or they will fly immediately; this is imperative. Take lid off bottle, skim froth off quickly, and fill up with boiling water. Put a good rubber ring on, then the lid, and lay the bottle gently on its side. If not quite air-tight, use a second ring. Cool gradually, and keep in a dark place.

Plums, grapes, gooseberries, and other small fruits do not require boiling. Pack carefully in bottles, pour boiling water over, put on rings and covers, and fasten spring over.

Fruit bottled in this way will keep good, and be clear and free from sediment for two or three years.—Mrs. Minnie Jonnes.

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Ginger Beer.

6 lbs. sugar, 1 teacup bruised ginger (not too fine), 1 packet cream of tartar, ½ packet tartaric acid, 20 cloves, 1 cup (small) bruised raisins.

Put everything in a small barrel or earthen jar, and fill up with boiling water. Next day put in two tablespoonfuls of yeast. Bottle the third day, that is to say, when raisins float on top, not before, and tie corks down well with string. This quantity makes 24 bottles. —Mrs. W. G. Hartogh.

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Peach Pickles.

6 lbs. peaches, 2 bottles vinegar, 2 tablespoonfuls tumeric, 1 heaped soup plate sliced onions, 1 tablespoonful whole coriander seeds, few orange or bay leaves, sugar and salt to taste.

Bring vinegar to boil, then add peaches; let boil for a few minutes, then put in all the other ingredients and bring to boil again.

Leave till quite cold, then bottle in air-tight bottles. Will keep for years.—MRS. W. G. HARTOGH.

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A correspondent from Mossel Bay kindly sent in the following recipe:—

ITALIAN CREAM.

Ingredients: 1 *packet jelly powder*, 3 *eggs*, 1 *pint milk*, 1 *tablespoonful whisky or brandy (to flavour).*

Make a custard of yolks of eggs and milk. Melt the jelly in a little hot water, and mix the melted jelly with custard. Bring the mixture to the boil once only. Beat the whites of the eggs to a stiff froth, and then add them to the mixture, after it has been removed from the fire, add flavouring. Pour the whole into a pudding mould to set, turn out and serve with custard or cream.

* * * *

The following interesting letter was received from E. L. H., Rietspruit:—

"It occurred to me on looking through the recipes in "Maize Foods for the Home" that the preparation of either maizena or corn-flour, on a small scale for domestic use, ought not to be very difficult. I have often heard old people say that in their youth home-made preparations from potatoes were their only substitutes for arrowroot, corn-flour, etc. By their description, the preparation much resembled the process used in Natal to-day for arrowroot. In a maize country like this we ought to be independent of American maize preparations, such as corn-flower or maizena, hominy, etc. Could any of your correspondents suggest an easy method for these? We ought not to be sending money out of the country for such things."

. . . .

In reply, we publish the following recipe from Mrs. D. Laffnie:—

MAIZENA.

Grate green maize over a dish or bucket of water; strain and let settle down; drain off water, and leave to get perfectly dry. Do not leave in water overnight. Starch can also be made in this same way.

* * * *

ICED FRUIT SALAD.

Take a nice ripe water-melon, cut off top, scoop out fruit, and cut into square pieces. Cut up ripe bananas, pineapple, apricots, apples, and any ripe fruit; add a few handfuls crystallised cherries, two handfuls sugar, and one tumblerful Kirsh or old wine. Mix all together and replace into melon. Replace the top, and set in ice-chest or cool place, where it can get nice and cold.—MISS H. ASHFORD.

III.—HOUSEHOLD SCIENCE NOTES.

1. Vegetables that form in heads, such as cabbage, cauliflower, etc., should be soaked, heads turned down, in salted cold water. If there are any worms or other forms of animal life in these vegetables they will crawl out.

2. Cheese may be kept soft by wrapping it in a cloth moistened with vinegar, placing it in an air-tight box, and in a cool, dry place.

3. In canning and preserving, place a silver spoon in the jars when filling them. Silver, being a good conductor of heat, takes the heat from the fruit, and thus lessens the danger of breaking the jar.

4. For canning and preserving never gather fruit when still wet with dew, nor on a rainy day, as such fruit will not keep well.

5. To keep flies out of a room, put a few drops of oil of lavender on a sponge placed in a saucer of hot water. This will give out a scent like violets, which flies dislike. If you do not care to try it in the house put the sponge on a table on the stoep if the flies are troublesome there.

6. To render clothing uninflammable, or at any rate so slightly combustible that it would take fire very slowly and not flame at all, add an ounce or two of alum to the last rinsing water when it is washed. Mosquito nets are so liable to take fire from candles or lamps, that it would be well to use this simple means to prevent accidents.

7. Dry bread-crumbs will dry-clean cretonne, chintz, or any similar material where there is a suspicion that the colours will run. The crumbs may be either tied in a piece of strong muslin, or may be used loosely in a large handful at a time. Chair covers which are not easily removed can be cleaned beautifully this way.

8. Wash tan shoes with soap and water and dry them before applying a tan shoe dressing, for, in this way, many stains are removed instead of being covered. Washing tan shoes with warm sweet milk now and then will prevent them from turning so dark.

9. To remove paint from clothing, mix in a cup equal parts of turpentine and ammonia, and apply the solution to the paint with a piece of cloth the same colour as the garment. Rub gently until the paint is removed, then sponge with warm water and a little white soap. This will not injure any fabric which will stand water.

* * * *

Washing as an Art.

Washing is an art; simple when you understand it. Dissolved soap is a necessity, and is made by finely shredding a quarter of a pound of yellow soap into one quart of water and boiling it till dissolved. A quantity can be made at one time and kept for use when required.

When washing flannels and woollen goods, never rub or twist them, and *never* rub soap on. Squeeze them about in tepid lather, to which (for white flannels) a little ammonia is added. Wash thoroughly on both sides, rinse carefully in water of the same temperature, shake and dry in the air, not in the sun, but dry as quickly as possible. Iron with a cool iron.

White silk blouses, ties, handkerchiefs are washed in the same way. First steep them in cool water with a little borax added, wash in a lather of warm water and dissolved soap, rinse well, pass through a wringer, and iron on the wrong side when nearly dry. A little methylated spirit added to the last water for silk blouses or handkerchiefs gives a desirable gloss. A desertspoonful to a pint of water is ample. For coloured silk do not steep in borax water, nor pass it

through blued water. If you fear the colour will run, steep it in salt water for a short time, but be careful to rinse out all salt before washing.—(*London Express.*)

When washing summer dresses keep the colours from fading by the following process: Dissolve one tablespoonful of powdered alum in a gallon of salt, lukewarm water, needed to cover the garment. Rinse thoroughly in this alum water, then wring slightly and put into suds made of warm water, not hot, and white soap. Wash carefully, using as little soap as possible. Rinse well in two or more waters, wring as dry as possible, and put through very thin cooked starch, not hot, and hang wrong side out in a shady place in the open air. Sprinkle as evenly as possible and let it lie tightly rolled for not more than half an hour before ironing.

* * * *

When thin dresses need freshening, but are not much soiled, put a tablespoonful of borax in a small bowl of water, take a clean cloth, dip it in the solution, and dampen the entire dress; then press on the wrong side with a hot iron. The borax will give just enough stiffness.—(*Ladies' Home Journal.*)

Useful Facts and Figures for Farmers.

SIMPLE MEDICINES FOR THE FARM, AND THEIR PROPERTIES.

THE following is a list of simple medicines which it would pay the farmer to keep always on hand for the treatment of cases of illness and accidents amongst stock:—

Epsom salts, 7 lbs.; raw linseed oil, 1 gallon; turpentine, 1 quart; tincture of opium, 12 ounces; bluestone, 1 lb., and Stockholm tar 1 gallon; which might be supplemented by calomel, 1 ounce (divided into 8 doses); rape oil, 1 quart; carbolic acid, 8 ounces; corrosive sublimate (1 bottle of Burroughs' Wellcome's soloids); one or two curved needles for stitching wounds; a hank of silk; one or two calico bandages; a pound of cotton wool or a bundle of tow, and a supply of Cooper's dip, which the farmer would probably have on hand. With these he would be fairly well prepared to deal with any of the usual cases of illness or treat any ordinary case of accident amongst his stock. This list might, of course, be lengthened with advantage, but the articles mentioned are really indispensable.

It is hardly possible to dwell at length on the properties of the various medicines named, but we will briefly mention those which are most important, and the doses of each:—

Epsom Salts.—A valuable laxative and aperient, particularly suitable for cattle. *Dose*: Cattle, 1 lb. to 1½ lbs.; sheep, 3 ounces to 6 ounces.

In administering this medicine it should be remembered that it is most effective if given with plenty of water, and, best of all, with warm water.

Turpentine.—We have no hesitation in describing turpentine as one of the most valuable medicines for general purposes that a farmer can have; given with linseed oil, together with tincture of opium, it makes a most useful colic drench; and for a horse a dose of an ounce and a half of turpentine (three tablespoonfuls), two ounces of tincture of opium (four tablespoonfuls), shaken up in a bottle of raw linseed oil, makes a very effective colic drench, which can be repeated in an hour if the animal does not get relief. Given this way, but without the tincture of opium, it is very serviceable in cases of hoven. Turpentine is also a very active worm medicine, and, when given for this purpose, should be mixed with linseed oil; lambs and kids take a teaspoonful of turpentine; calves a tablespoonful; dogs 20 to 30 drops; ostriches from a dessertspoonful for a three months' old chick to two tablespoonfuls for a full-grown bird.

It should be remembered that worm medicines are most likely to be effective when the patient has been well fasted before the medicine is administered.

Externally, turpentine is a useful antiseptic, and a dressing of turpentine—one part to six parts of rape oil—makes an excellent application for wounds, promoting healing and keeping off flies. Applied pure, it is useful in cases of injuries to the foot, as, for

example, when a horse has picked up a nail, the application of a little pure turpentine will cleanse the wound as a preliminary to applying a poultice. Turpentine is also useful for arresting bleeding from a wound, and, for this purpose, the wound may be plugged with a wad of cotton wool or tow wetted with turpentine, the plug being kept in position for twenty-four hours. It should not, however, be applied pure to the skin of any animal as it is extremely irritating.

Tincture of Opium.—A valuable sedative, most useful for allaying pain and relieving irritation. *Dose*: Horse, one to two ounces (two to four tablespoonfuls); cattle, two to four ounces; sheep, one to two teaspoonfuls.

Combined with linseed oil and lime water, a bottle of each, with four or five tablespoonfuls of tincture of opium, it is effective in cases of tulp poisoning, and, as already mentioned, may be given with turpentine and linseed oil in cases of colic.

Bluestone.—An excellent worm medicine, and useful as an occasional application to unhealthy wounds.

Given internally, it must always be well diluted; calves about six months old will stand about 30 grains dissolved in at least half a pint of water; for sheep, dissolve 1 lb. in 60 bottles of water, and give from $1\frac{1}{2}$ ounces to 5 ounces, according to age—quantities recommended by Dr. Hutcheon for the treatment of wire worms being as follows:—

For lambs 3 to 6 months	..	$1\frac{1}{2}$ to 2 ounces.
,, 6 ,, 9 ,,	...	3 ,,
,, 9 ,, 12 ,,	...	$3\frac{1}{2}$,,
,, 12 ,, 18 ,,	...	4 to $4\frac{1}{2}$,,
,, 18 months and over	...	5 ,,

It should be remembered that these are full doses, and if animals are at all debilitated and out of condition it is well to try the effect of the dose on a few of the weaker animals in the flock and to wait a few days and note the effects before dosing the rest. Like turpentine, bluestone should always be given after the animals have been fasted, sheep being fasted from 20 hours to 30 hours before being dosed, and being kept away from water for the rest of the day on which they are dosed. Care must also be taken to administer the medicine slowly, otherwise some of it may find its way into the lungs and cause death by setting up inflammation of the lungs.

Stockholm Tar.—As a worm medicine may be given to sheep instead of bluestone. For the treatment of wire worm the dose for sheep is one to two tablespoonfuls on the tongue; the dose should be repeated two or three times with an interval of four or five days between the doses. Externally, mixed with washing soda and water, in the proportion of one part of stockholm tar and six ounces of washing soda to three gallons of water, it is useful for clearing ticks from the ears of cattle; and mixed with finely powdered bluestone it is an excellent application in cases of footrot in sheep.

Calomel.—A very valuable liver medicine, useful in cases of gall-sickness. *Dose*: Cattle, one drachm (the eighth part of an ounce); for sheep, 10 grains. For gall-sickness in cattle give the above dose of calomel shaken dry on the back of the tongue, and follow this in about eight hours' time by a dose of epsom salts (1 lb. dissolved in six bottles of warm water). Calomel is also useful in biliary

fever in dogs, but, to have any good effects in cases of this disease, it needs to be given in large doses (20 grains for a dog about the size of a bull terrier).

Externally, applied dry, it is useful for drying up small wounds and saddle-galls; and a little of the dry powder blown once a day into the eye for two or three days often clears up the cloudy appearance commonly seen in the eyes of cattle which have suffered from inflammation of the eyes.

Rape Oil is a bland unirritating oil, useful as a dressing for wounds when mixed with turpentine or carbolic acid. (See carbolic acid and turpentine.)

Raw Linseed Oil is a laxative, particularly useful for horses and calves, given in conjunction with turpentine and tincture of opium, in quantities already mentioned, it forms an excellent colic drench. Mixed with equal parts of lime water it forms what is known as carron oil, a most soothing application for burns and scalds, and, in this form, with the addition of three or four tablespoonfuls of tincture of opium, and given to the extent of two bottlefuls, it is serviceable in cases of tulp poisoning. *Dose*: For horses, 1 to 2 pints; calves, up to 6 ounces; sheep, up to 6 ounces. It may also be given with carbolic acid, quinine, and calomel in the treatment of redwater—for this purpose it should be given in the following manner:—

Calomel	1 drachm (60 grains);
Carbolic acid	1 drachm (one teaspoonful);
Quinine	2 drachms (2 piled teaspoonfuls);

well shaken together in a pint of raw linseed oil, to be followed after a few hours by a similar dose from which the calomel has been omitted and the quantity of oil reduced to 12 ounces. The latter dose may be repeated every twelve hours as long as necessary, but, to be of benefit, must be begun early. Mixtures containing carbolic acid must always be given slowly and carefully otherwise there is some risk of suffocating the patient.

Carbolic Acid.—A most useful application to wounds; it must not, however, be applied pure, but should be mixed with water or oil in the proportion of one part of carbolic acid to twenty of water, or ten of oil. Externally it is given, combined with calomel and linseed oil, in the treatment of ordinary redwater (see linseed oil).

Corrosive Sublimate.—A very powerful antiseptic; one tabloid dissolved in three pints of water, making a solution of 1 in 3,000, forms a useful eye lotion in those cases of inflammation of the eyes so frequent amongst sheep and cattle at certain seasons—used for this purpose it should be squirted on the surface of the eyeball once or twice a day with a glass syringe. A solution of the same strength may also be applied to wounds.

Cooper's Dip owes its medicinal properties largely to the arsenic which it contains; is a very useful blood medicine and one which is very effective for the treatment of worms, in addition to being an excellent dip for scab it is used as a preventive of geilziekte. For worms in lambs or kids, 2 tablespoonfuls, or 2½ ounces, should be mixed in 1 gallon of water (6 whisky bottles), and thoroughly stirred; the dose of this solution for lambs or kids is 1 ounce (about 2 tablespoonfuls), for older animals 2 ounces or 3 ounces. It may

also be given dry, mixed with salt, in the proportion of one part of dip to ten of salt; of this the dose for sheep is 1 teaspoonful, two or three doses given at intervals of three or four days often suffice to check mortality from geilziekte when it has made its appearance amongst a flock.

C. E. GRAY, M.R.C.V.S.,
Principal Veterinary Surgeon, Transvaal Department of Agriculture.

REGULARITY OF FEEDING AND MILKING.

The great importance of feeding and milking cows with the utmost regularity has not received the attention which it should. When the time comes for feeding the cow it expects its feed, and if it does not get it there will be some loss of flesh or lack of progress, and the more regularly the cows have been fed in the past the greater will be the loss consequent upon irregular feeding.

But the loss from irregularity is nowhere more apparent than in milking. Some dairymen milk a little later on Sunday morning than through the week. The following test shows the folly of this practice. A prominent dairyman in Pennsylvania delayed milking his cows on Sunday morning for an hour and a half, and there was a large shrinkage in the milk yield that evening and on the following day. From fifty cows the shrinkage on Monday morning was about one hundred pounds, or an average of two pounds apiece. That dairyman will never again let his cows go over the regular milking time on Sunday morning.—(*The Canadian Dairyman and Farming World.*)

RAISIN-MAKING.

All grapes for raisin-making should be dead ripe, as three or four days make a great difference in the amount of sugar in the grapes, and, consequently, in the quality of the raisins. All grapes do not ripen at the same time, therefore the experienced grower will pick over the vineyard several times, each time picking only the ripened grapes. Each bunch must then be cleaned, every sunburnt berry and all foreign matter being removed. Then they are placed on trays, and the grapes are gradually dried by the sun. The best temperature is from 90° to 103° in the shade. A much higher temperature will not injure very ripe grapes. When the heat is such that the raisins would cook and spoil, the trays should be stacked to protect the fruit until the heat has become less intense. After a few days' exposure to the sun in the vineyard, the grapes must be turned, as the grapes exposed to the sun will have dried, whilst those underneath are still green. The turning should not be done until the upper berries have quite dried, and the morning hours should be chosen for the work. The trays of dried fruit have next to be stacked. After remaining in the stack for some days, the raisins are placed in sweat boxes, 6 inches to 8 inches deep, for a couple of weeks, and are then ready for packing. It takes about three tons of grapes to make one ton of raisins.—(*Queensland Agricultural Journal.*)

BEST TIME TO KILL OLD HENS.

The best time to kill old hens, or to sell them to dealers for killing, is just as they begin to moult, for they will then have ceased laying and yet will not have lost condition. But if they are allowed to run for two or three weeks after the moult has set in, they become thin and scraggy, and are of very little use for eating.

It is not always possible to know by the appearance of fowls as they run about the yard whether moulting has begun or not, but the signs, other than the actual casting of the feathers, by which a hen in moult may be recognised, are mopishness, loss of appetite, and paleness of head and comb. If the birds are examined while on the roost, those moulting can be detected, because their crops will be only half full, whilst hens which are in full lay, and have not begun to moult, will have full crops at roosting-time.—(*The Canadian Dairyman and Farming World.*)

HOW TO GET THE PIG'S WEIGHT.

To tell the weight of swine, measure the girth in inches back of the shoulder, and the length in inches from the square of the rump to a point even with the point of the shoulder-blade. Multiply the girth and length, and divide the product by 144. Multiply the result by 11 if the girth is less than 3 feet, or by 16 if over 3 feet. The answer will be the number of pounds of pork. If the animal is lean and lank, a deduction of 5 per cent. from the above should be made.—(*Journal of Agriculture, Western Australia.*)

Extracts from Exchanges.

PROTECTION OF BIRDS IN GERMANY.

The Board have received through the Foreign Office a report by Sir William Ward on the steps taken for the protection of birds in Germany. It appears that the gradual disappearance in Germany of birds of all descriptions, but particularly of those kinds which are regarded as specially useful to agriculture, led, about two years ago, to the establishment at Hamburg of a State institution for protecting and preserving birds in the adjacent rural districts. The institution was organised and is directed by the professors of botany attached to the Hamburg Botanical Gardens, whilst its practical management, that is to say, the carrying out of the various measures destined for protecting the birds, is placed in the hands of an inspector or so-called "birdsman" (vogelwart).

The "birdsman" has been specially trained for his work by a German landowner (Herr Von Berlepsch), who has long made the care of birds his special study. Herr Von Berlepsch has laid down rules for the proper construction of nest boxes and for hanging them up in suitable places, as also for planting bird thickets—the two chief methods recommended by him for the protection as well as the propagation of birds.

Several extensive parks and gardens near Hamburg have now been supplied with boxes, as well as most country places within Hamburg territory, the birds for which they are intended being tomtits, starlings, and woodpeckers. During the year 1907 the Hamburg rural authorities have distributed 1,200 nest boxes free of charge, whilst 300 have been sold, and, altogether, about 4,000 nest boxes are said to be in use in the neighbourhood of Hamburg.

One method for the protection of birds is the planting of thickets for shelter, and the local authorities are about to establish in one of the country districts a large thicket measuring about 2,000 square yards. This thicket is to consist chiefly of blackthorn bushes at a distance of about 2½ feet from each other. After every twelfth bush, beech, ash, and fir trees are planted: there will be smaller groups of wild currants and gooseberries, and, around the whole, there is to be a protective fence of wild rose bushes. It is stated that, in the course of a very short time, an animated bird life develops within these thickets.

The Prussian Government have issued several pamphlets describing these nest boxes and thickets with a view to encouraging the preservation of useful birds.—*(The Journal of the Board of Agriculture.)*

* * * *

DESTRUCTION OF RATS IN DENMARK.

For some years past a campaign against rats has been conducted in Denmark. A committee was formed for this purpose in 1898, and, in 1899, an attempt was made to encourage the destruction of rats in Copenhagen by the payment of a premium of about 1½d. per head. A sum of £550 was raised, and the permission of the Municipality

was obtained to use the fire stations as receiving depots. A sum of about 2s. a day was paid to a fireman at each station for acting as receiver. The experiment lasted from the 3rd August to the 9th December, 1899, during which time 104,000 rats were killed at a total cost of less than £750. Consequent on this example, similar attempts were made in several provincial towns and on several estates. In the latter cases the premium was reduced by about one-half on the ground that, in country places, the interest of everyone in the destruction of rats is so great that a much smaller sum is necessary to stimulate active efforts in that direction. In towns it was found that large numbers were brought in by children and by men who were out-of-work, many of whom took to this occupation as a means of livelihood.

The success obtained by these voluntary efforts led to a demand for legislation, and, in March, 1907, a law was passed enabling rural and urban communes to undertake measures for the destruction of rats in their districts, and to provide for the payment out of the rates of a premium of from ¾d. to 1½d. per rat. A sum of £1,650 is to be paid out of the public funds annually for three years, of which one-third will be devoted to scientific experiments, and the remainder to the purchase of poisons and destructive agents for use on the State properties or otherwise.

LARD AS AN EGG PRESERVATIVE.

Italian and French experts have, of late days, become convinced that lard as an egg preservative is to be highly commended. Dr. Campanini, an Italian agricultural authority, after reviewing the various known means of preserving eggs—by salt water, lime water, silicate of potash, vaseline, and cold storage—described his lard experiments, which showed better results than all others. His theory is that, to preserve eggs, some system must be adopted that will absolutely prevent the exchange between the air outside and that inside the eggs, for it is this continual exchange that causes putrefaction. Dr. Campanini selected perfectly fresh eggs and covered them with lard so as effectually to stop up all the pores. The shells were thus rendered impermeable, the exchange of air was prevented, and, the obstruction of the pores not permitting the evaporation of the water, there was no loss of weight. The whites and yellows of the eggs retained their colours perfectly, and the taste was not modified in the slightest degree. When properly caked with lard, not too thickly, the eggs are put in baskets or boxes on a bed of tow or fine, odourless shavings, and so arranged that there will be no point of contact between them; otherwise a mould will develop and putrefaction result. The packing-room should be perfectly dry, the question of temperature not being important. By this process Dr. Campanini kept a quantity of eggs for a whole year, through a very hot summer and a very cold winter, and they were perfectly preserved. He says that threepennyworth of lard suffices to coat 100 eggs, and that any one could easily prepare that number in one hour's time. Some authorities take exception to the smearing of eggs with fat or lard. Lime water, on the other hand, is strongly advocated by the Canadian poultry experts.—(*Agricultural Gazette.*)

SELECTING SEED POTATOES.

This is a matter which has a very important bearing on the future of the industry. All householders know how difficult it is to obtain good potatoes, and the trouble is becoming more and more emphasised every year. As pointed out by Mr. George Seymour, the potato expert employed by the Victorian Department of Agriculture, medium or small-sized potatoes are generally reserved for seed, all large tubers being sold. No attempt is made to trace the history of what is chosen and the whole tendency is to breed down instead of up. He feels sure that the introduction of new varieties of seed will not in itself do anything more than temporary good. The real cure for the ills that beset the potato industry is to be found in much greater care on the part of the individual grower, and one thing that requires to be placed on a new footing is the selection of seed.

The selection, as Mr. Seymour points out, must be made at the time the crop is being dug, not months afterwards. As each root is being dug the whole of the potatoes it has produced, big and little, should be spread out on the surface of the land, and the grower himself should select the necessary quantity for his next crop before they are bagged. Only those stalks should be chosen that have produced a fair number of tubers, uniform in size and shape, and without a large percentage of "pig" potatoes. Uniformity of character and trueness of type are the most essential points to be sought for. If a farmer will take the trouble, year by year, to select the best seed in this way, he will find that the quality of the potato will be maintained and the yield improved, so long as the soil and moisture are right.—(*Journal of Agriculture, Western Australia.*)

A NEW GARDEN OF EDEN.

A Reuter's telegram from Constantinople announces that it had been decided to engage Sir William Willcocks, K.C.M.G.,* the eminent authority on irrigation works, as adviser in connection with the irrigation works in Mesopotamia for a period of five years. "My hopes, my ambitions, my work are bound up with the re-creation of Chaldea," said Sir William Willcocks some time ago when discussing his plans for rebuilding the vast irrigation canals in that ruined country.

For years he has been perfecting his gigantic scheme for restoring the ancient Chaldean irrigation works on the Euphrates and Tigris, the traditional site of the Garden of Eden. He has made a number of trips through these valleys, and is convinced that the construction of irrigation works would be comparatively easy and inexpensive. If the ancient system of irrigation were restored, it is estimated that sufficient grain could be grown in the valley of the Euphrates alone to alter the conditions of the wheat supply of the world. Excavations made at various places along the river shows that the ancient system

* It is interesting to remember that Sir William Willcocks reported on Irrigation in South Africa in the year 1901.

of canal existed as long ago as 4000 B.C. It passed from the Persians to the Arabs, who long maintained it in working order. Many ancient writers mention the wonderful fertility of the country watered by the Euphrates and its canals. Its decline began with the invasion by Turkish nomads in the eleventh century.

Sir William Willcocks has had a brilliant record as an engineer. Born in India fifty-six years ago, he was educated at Roorkee College, and then entered the Public Works Department of India, where he spent eleven years. In 1883 he entered the service of the Egyptian Government. His greatest achievement was the designing and constructing of the Nile dam at Assouan.—(*The Scotsman.*)

Correspondence.

This column will be devoted to correspondence, and an endeavour made to reply to all enquiries upon agricultural topics, or concerning any of the articles published from time to time in the "Journal."

Correspondents will kindly write on one side of the paper only. No manuscript will be returned.

All letters must be addressed to the Editor of the "Agricultural Journal," Department of Agriculture, Pretoria.

EXPORT OF MAIZE.

Through the courtesy of the General Manager, Central South African Railways, we have pleasure in publishing the following interesting letter from Mr. A. R. Morison, Helouan, near Cairo, Egypt :—

Having made enquiries here as to the demands and price of maize, I think the opportunity offers of doing a certain amount of business if I can obtain shipments of maize, properly bagged and of uniform quality and size. I am prepared to do business with the Government, that is if they have a department which is superintending the shipment of maize, or with a reliable firm, but I must impress upon you that if a shipment is not of uniform quality and according to samples it will destroy all confidence with the bank that advances on grain, and also local buyers, and will prevent me establishing a trade. I know the Government is doing its utmost to encourage export, and I leave it to them to see that I am protected.

Methods of Dealing.—There are two ways :

1. Selling on commission, that is for firms, which does not appeal to me.
2. Buying direct. This would be better for both parties, as it might be necessary for me to split up the shipment and sell it in different districts.

Method of Shipment.—The sellers would ship via East Coast to Suez, avoiding canal dues. The shipping company might grant low rates for some time in order to start the trade.

Prices.—Sellers' prices include insurance and everything else, including landing charges by steamer at Suez.

Duty.—Payable by me at Suez.

Samples.—I would require 5 lb. samples of the different grades, with inclusive price, sent me every six weeks.

Method of Purchasing.—I should purchase by cable, and on receipt of your advices through which bank and on whom to draw. I use the expression on whom, as I may have to deal with some firm here who have agencies in the provinces and the facilities for storing grain.

Prices.—State price per 100 lbs. I think your sacks are 206 lbs.* I shall be glad if you will expedite the business as soon as possible by giving the contents of my letter to a reliable firm ; they can then at once write to me and so save delay.

* The weight of a bag of maize in the Transvaal is 203 lbs.—EDITOR, *T. A. J.*

BUTTERMAKING.

To the Superintendent of Dairying.

Sir,—Will you please tell me the average amount of milk (in gallons and pounds) required to make one pound of butter; also the safest method of preserving the butter?

After separating the milk, should the cream be cooled rapidly, and is it wise to mix it with stale cream?

What breed of stock is considered most profitable for dairy purposes?

Yours, etc.,

ROLLO BEAN.

Christiana.

Answer.—I do not think the mentioning of an "average" amount of milk required for a pound of butter will be of much use to you, for if you come to compare this average to a case in practice you might find an entirely different figure. In general 20 to 30 lbs. of milk will yield 1 lb. of butter, but I know of cases where 17 lbs. of milk were sufficient and other cases where 35 lbs. were required. The weight of a gallon of milk varies from 9 to 10 lbs., usually keeping within the limits 9¼ to 9¾ lbs.

The sooner and deeper you cool the cream after separating the better it will be. Do not mix stale and fresh cream if you can possibly help it. I have just published two pamphlets, entitled "A Butter Dairy," and "Buttermaking," which contain more detailed information that is likely to interest you. You can obtain these, free of charge, on application to the Government Printer, Pretoria.

Your last question, which breed of stock is most profitable for dairy purposes, I cannot answer without possessing full particulars about your farm—crops, situation, etc. At present the Ayrshire and the Friesland are attracting most attention in this country—which of the two is better adapted in the long run, time will show. The Friesland gives a better ox than the Ayrshire.

ROBERT PAPE.
Superintendent of Dairying.

HERBAL TAINT IN MILK.

To the Superintendent of Dairying.

Sir,—I shall be glad if you would give me a remedy for a herbal taint in milk. We send a daily supply of milk to Johannesburg, and have received complaints of the taste of the milk. The taste is undoubtedly caused by some herb or by the old grass in the veld, but we have been unable to locate the cause. Meanwhile it is of the greatest importance that we should minimise the taint in some way if possible. Could you give me the proper proportion of saltpetre and method of using, as I understand this is a remedy commonly used to remove objectionable flavours.

Yours, etc.,

A. H. BARRON.

Platrand.

Answer.—You state the taint in the milk is decidedly due to some herb, but you cannot locate it. Under these circumstances I must say it is open to doubt whether the taint is due to a herb. A great many tastes like "fodder taste" or "herbal taste" are due to action of germs, and in most cases will disappear on pasteurising the milk. An instrument for pasteurising a small quantity of milk in bottles is described in the July *Agricultural Journal*—for larger quantities a special apparatus will be required.

If the case is really due to some plant, a radical remedy is to prevent the cattle from eating the noxious herb. In some cases real fodder or herbal taints will disappear during pasteurisation, that is, heating the milk under continuous stirring to 160-170 degrees Fahrenheit. Then cool it, under stirring, as low as possible. As a rule saltpetre is no good, but it is conceivable that it might in some cases counteract the taint, especially if the actual cause is unknown. However, I should not try saltpetre in this case, but would first see what pasteurisation will do.

ROBERT PAPE,
Superintendent of Dairying.

SEPARATORS AND CHURNS.

To the Superintendent of Dairying.

SIR,—I am going to make some butter this season to sell, and would like to have your advice.

What separator and churn do you recommend? What is the best temperature to churn at? And is there any benefit in making the butter every day: or letting the cream stand, and churning twice a week?

I will have from 20 to 30 mixed cows for milking, so would like your advice in order to be able to work them to some account. Do you recommend the placing of the butter on the market in large or small quantities?

Yours, etc.,
B. SPRAGGON.

Breyten, District Ermelo.

Answer.—I do not like to recommend one particular churn or separator as "the best," but prefer to mention a few that are deservedly popular.

I think in separators the following are among the best machines:—"Alfa Laval," Burmeister & Wain's "Perfect," "Melotte." There are a great many imitations of these makes on the market under different names, and if these imitations are very similar to the originals and made out of good metal, they should give satisfaction. Take, for instance, the "Alfa Laval" and the "Perfect"—these two are very similar. Then the "Austra" and the "Westphalia" seem to me imitations of the two types mentioned.

In churns there is a great variety of types on the market, and I really do not think it makes much difference which type is chosen if the churn is well made out of good wood and easy to clean. In this country the "End over End" is rather popular. One of the best churns, too, is one of the oldest, viz., the "Holstein." Very good results are also obtained from the American "Box Churn" and the "Swing Churn."

For the quality of the butter the best plan is to churn daily, and if large quantities of cream are available to churn *twice* daily, keeping the cream from morning's milk and evening's milk quite separate. The more you limit the frequency of the churning, the more the quality of the butter will suffer. But the point for you to consider is whether the extra labour and inconvenience caused by churning daily is paid for by the improved quality of the butter. With larger quantities of butter it certainly pays to churn as frequently as possible.

For placing the butter on the market I think the best plan is either to make contracts with retail shops or to serve consumers direct by agricultural post or by rail.

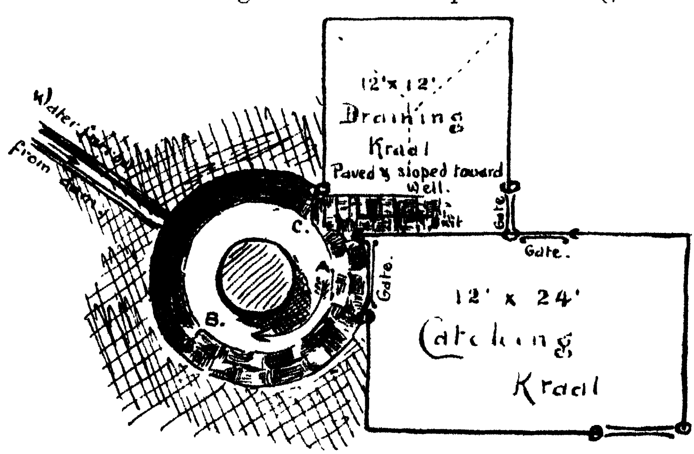
ROBERT PAPE,
Superintendent of Dairying.

DIPPING TANK.

To the Editor of the *Agricultural Journal.*

SIR,—The following are some particulars regarding the dipping tank, designed and constructed by me, which may be of interest to readers of the *Agricultural Journal.*

The dimensions are as follows:—Depth, 4½ feet; diameter, 5½ feet. In the centre a conical pillar is built, with a base of 3 feet and summit 18 inches, round which the sheep swim when being dipped. The exit is 10 feet long, being sloped from within a foot of the bottom of the well, and is paved with rough sandstone slabs, but not cut into steps. A sliding door at the mouth of the exit prevents escape of sheep till permitted to do so. This rough sketch will help the working of the dip.



The sheep are caught in the kraal and plunged into the well at A, with head towards B, and continue swimming round till allowed to escape at C, where a sliding door is operated as required. Seven sheep may be put in at once. A man standing on the centre pillar with a forked stick ducks the sheeps' heads as they swim round him. The whole thing is built of dressed sandstone laid in with cement.

Yours, etc.
J. H. TUCKER.

Rooderand, Kroonstad, O.R.C.

DESTRUCTION OF RATS.

To the Editor of the *Agricultural Journal.*

Sir,—I shall be much obliged if you will kindly advise me as to the best way of getting rid of rats. My house and buildings are swarming with them, and they are doing an immense amount of damage.

Yours, etc.,
CORNELIUS VAN DER WESTHUIZEN.

P.O. Rustoord, Heidelberg.

Answer.—Experiments were recently conducted at this Laboratory with a rat-destroying material called "Ratin," the rodents being killed within half an hour from the time this "Ratin" was administered. This material was also distributed in our stables and forage stores, and since then there has been a noticeable decrease in the number of rats. The agents for "Ratin" are Messrs. B. Owen Jones & Co., Boksburg.

ARNOLD THEILER,
Government Veterinary Bacteriologist.

BLINDNESS IN SHEEP, GOATS, AND CALVES.

To the Editor of the *Agricultural Journal.*

Sir,—It may be of interest to your readers to learn that paraffin oil is a cure for blindness in sheep, goats, and calves.

I have been much troubled with blindness in my sheep and calves, and could never find a cure for it. For the last three years I have been using paraffin oil, with the result that I have not had one blind.

The way I use it is as follows:—I take a small kitchen lamp and let the oil run from the wick into the eye. If treated in this manner, as soon as the eyes are noticed to be running, it will be found a reliable cure.

Yours, etc.,
N. S. MOORE.

Honesty, P.O. Fourteen Streams.

MANURE FOR POTATOES.

To the Editor of the *Agricultural Journal.*

Sir,—As I am just about to commence planting potatoes, I will be glad if you would send me the comparative value of stable and artificial manures.

Yours, etc.,
P. GEO. GREWAR.

Boksburg.

Answer.—Stable manure varies very greatly in composition, but the following figures represent about the average percentage of manurial ingredients:—

	Per Cent.
Nitrogen	0·5
Potash	1·0
Phosphoric acid	0·4

If we take Safco potato fertilizer as a typical mixture of artificial manures for potatoes, the following are the figures:—

	Per Cent.
Nitrogen	4
Potash	3
Phosphoric acid	12

The latter, therefore, contains eight times as much nitrogen, three times as much potash, and thirty times as much phosphoric acid as the stable manure.

If the nitrogen, potash, and phosphoric acid are given the same value in each case, then the artificial manure would be worth about nine times as much as the stable manure. The actual price of Safco potato fertilizer is £7 15s. per ton at Durban, or £9 10s. 9d. per ton at Germiston; so that, looking at the matter from a purely empirical point of view, one ton of stable manure ought to be worth $\frac{£9\ 10s.\ 9d.}{9}$ = £1 1s.

A great many other factors, however, have to be taken into account, the most important of which are the following:—

The nitrogen in stable manure is not in nearly such an available condition as in artificial manures, and the same is true to a less extent of the phosphoric acid and the potash.

The cost of applying the stable manure would be much greater.

The stable manure would improve the physical properties of the soil, making it more retentive of moisture—a matter of no small importance. On the other hand it is apt to contain weed seeds, which are sure to give rise to trouble.

Again, stable manure is not so well balanced a manure for the soils in this country as a specially-prepared potato fertilizer. Soils in this country are usually deficient in phosphoric acid or phosphates, and this is precisely the ingredient in which stable manure is weak.

What I would advise you to do is this:—If you can get plenty of stable manure near at hand for a nominal price by all means use it for your potatoes at the rate of about 10 tons per acre. In addition use about 300 lbs. superphosphates per acre. Such treatment ought to give excellent results, though weeds may give you some trouble. If you have any difficulty in obtaining stable manure on satisfactory terms you could not do better than use a special potato fertilizer at the rate of about 500 lbs. per acre.

R. D. WATT,
Acting Chief Chemist.

WINTER PASTURE GRASS.

(*Re Phalaris commutata.*)

To the Government Botanist and Agrostologist.

SIR,—I wish to order from Messrs. George Carter & Co., Pietermaritzburg, some grass roots (say 500 roots of *Phalaris commutata*) which they are advertising. Will you kindly furnish me with the

necessary permit, which I understand is needed on account of the prevalence of East Coast fever in Natal? If there is the slightest risk of introducing disease I, of course, do not want a permit.

Yours, etc.,
JOHN A. NESER.

Klerksdorp.

Answer.—In reply, I regret to say that we cannot grant a permit for the introduction of rooted plants from Maritzburg owing to the great danger of the introduction of inoculated ticks by this means. Furthermore, I would point out that up to the present our experiments with this grass have not proved satisfactory (perhaps on account of an exceptionally unfavourable season), and until we have given it further trial I would strongly advise farmers to await our results before spending money over it.

Yours, etc.,
JOS. BURTT-DAVY,
Government Agrostologist and Botanist.

COCKROACHES.

To the Editor of the *Agricultural Journal.*

Sir,—I have the misfortune of possessing a house which is teeming with cockroaches. No buffet or larder is free from their obnoxious presence. Numerous suggestions by friends as to their riddance have proved ineffectual. Can you, therefore, kindly advise me in this respect, and suggest an effectual remedy? Are you also, perhaps, acquainted with any chemical substance or liquid, which, when placed in a room, would prevent mosquitoes from entering?

Yours, etc.,
IVANHOE M. LOMBARD.

Klerksdorp.

Answer.—With reference to the subject of cockroaches, I may state that in a house where there are only a few in a room a trap can be constructed which will effectually keep them in check. This trap may consist of a box or closed jar with a top which slides inward towards a small hole. This hole can open upon a dish of some food of which the cockroach is very fond. They will gather on the top of the trap, slide through the hole into the dish, and cannot get out from there. They can then be destroyed the following morning. The trap should be set in some place which the cockroaches frequent.

Another remedy is to put phosphorous paste upon pieces of bread, and put this in a place which they frequent at night, or as an alternative a mixture of chocolate and borax can be placed upon bread and set in their tracks. This mixture of chocolate and borax should be ground in a mortar, so that the mixture should be made very thorough.

If either of these poisons are continued sufficiently long they will probably keep the cockroaches effectually in check. When, however, cockroaches are very numerous in a house, fumigation with hydrocyanic acid gas should be resorted to. This method of fumigation is

perfectly harmless if ordinary precautions are taken and the following instructions adhered to, but the chemicals should be kept locked up, and no person or animal allowed to enter while fumigation is going on.

Method of Fumigation.

1. Measure the cubical capacity of the room or rooms to be fumigated.
2. Take 1 ounce of cyanide of potassium, 1 ounce of sulphuric acid, and 2 ounces of water to every 100 cubic feet of space.
3. If the room is a large one, three or four enamelled dishes should be employed, and should be placed far apart in different parts of the room.
4. Into these dishes first place the requisite amount of water, and pour slowly into it the requisite amount of sulphuric acid.
5. Now place the proportionate amounts of cyanide of potassium into paper bags (thin paper bags similar to those used by a grocer).
6. See that the room is now made air-tight, or as nearly so as possible, and *be very careful to remove all foodstuff and water or drinkables of any kind from the room.*
7. Now take the cyanide of potassium (made up in paper bags as mentioned) and quickly drop each bag separately into each dish used, and leave the room at once, seeing that the door is shut and locked, so as to prevent children or others from entering.
8. Allow the room to remain closed for at least four or five hours. It is better to carry out the fumigation at night time, and allow the room to remain closed during the night.
9. On opening the room do not enter, but allow a free current of air to penetrate, and leave open for at least half an hour before you enter. For this purpose it is best to arrange the windows so that they can be opened from the outside.

When the paper bag containing the cyanide of potassium is thrown into the water containing sulphuric acid in solution it generates hydrocyanic acid gas, and this gas is highly poisonous, and will destroy the cockroaches.

The reason for suggesting that the fumigation should take place over night is that the cockroaches are more likely to come out of the cracks and crevices in which they exist at night time than during the day, and thus are more readily subjected to the poisonous effects of the gas.

D. Gunn.
Acting Entomologist.

To the Editor of the *Agricultural Journal.*

Sir,—In view of the remarkable conclusions recently arrived at by Professor Metchnikoff, of the Pasteur Institute, as to the great value of soured milk both as a food and a preventive of disease, may I venture to suggest that some member of the Agricultural Department write an article on "Maas," a kind of sour milk, which forms the staple food of several Kaffir tribes in South Africa. The preparation of the article would no doubt involve a somewhat extensive

enquiry, but the results would probably more than justify the trouble taken. For instance, it would be not only extremely interesting, but most useful, to have points such as the following elucidated:—

Have Kaffir tribes who live mainly on maas a low infantile mortality; and are they comparatively free from such diseases as enteric, dysentery, diarrhœa, rheumatism, gout, diabetes, gravel, eczema, etc.?

The importance of Professor Metchnikoff's conclusion as far as the agricultural community of the Transvaal is concerned lies in this: That if he is right, soured milk should not only displace tinned milk, but it should become a common article of diet. Soured milk, if properly prepared, will keep for more than two days, so that the Ermelo farmers or any other distant part of the Transvaal near the railway could supply not only the market of Johannesburg, but even that of Durban.

Maas is not the best form of sour milk. The best is prepared from boiled skim-milk with lactobacilline powders. The powders need, of course, be used only to sour the milk in the first instance; fresh supplies can be made by using a little of the milk previously soured. I may add that maas is also the Persian name for a form of sour milk which is known in Turkey as yaoort.

Yours, etc.,

SAMUEL EVANS.

Johannesburg.

Editorial Notes.

In the pages of this *Journal* we have spoken, from time to time, of those splendid agricultural colleges in the United States of America which have done so much to promote the agricultural industry of the Republic, and in this number it seems fitting that we should again urge the need of a great agricultural college for the Transvaal. It is with this end in view that, in this issue, we have reviewed at considerable length the history of those magnificent endowments for the promotion of agriculture which are known in America under the names of the Morrill, the Hatch, and the Adams Agricultural Acts. Now the significance of these aids to the agricultural industry will be more fully realised when we state that the total value of the fund established by the National Government under the Act of Morrill is to-day worth approximately one hundred million dollars; while the income accruing every year from the Hatch and Adams fund is now close on a million dollars. Furthermore, it should be remembered that the Morrill Endowment Fund was deliberately established when the United States was face to face with a war debt of £200,000,000 and in the darkest hour of her national peril. But it may be said that a small State like the Transvaal cannot, with any sense of fairness, be compared to the vast, the prosperous, and the populous United States. This is true enough, but only in a strictly limited sense. For we may not forget that all the gold mines of the great Republic represent only one-half of the colossal and ever-growing output of the Transvaal. And these things must surely lead us to reflect most seriously upon the wise words of the brilliant scientist, Professor Huxley, who remarked to an American audience in his final lecture on University education at Baltimore: "I cannot say that I am in the slightest degree impressed by your bigness, or your material resources, as such. Size is not grandeur, and territory does not make a nation. The great issue, about which hangs a true sublimity and the terror of over-hanging fate, is what are you going to do with all these things? What is to be the end to which these are to be the means?"

What, then, is the lesson for the Transvaal? We have our Department of Agriculture and our farmers' societies in every district of this Colony, but our agricultural edifice will not be complete until we raise a great agricultural college on the corner stone of national endowment. A short time ago eight lads were sent abroad at Government expense to equip themselves in practical and scientific agriculture. But many bright youths remain behind who are equally eager to acquire such learning as will enable them to serve their country to the fullest extent. And there is another phase in this problem. The Transvaal is an inland State—far from the coast—and our most important markets will always be oversea. Does it not behove us to make some sacrifice to assist our farmers to compete successfully with those more fortunate agriculturists who are in touch with the great industrial centres of Europe?

How can this best be done? To our mind the first and most pressing thing is to set aside a sufficient sum of money to establish a permanent endowment fund for agricultural education. For that reason we would most earnestly plead, in the name of the agriculturists of this Colony, for a Government endowment fund of one million pounds (£1,000,000) for the establishment of a national college of agriculture in the Transvaal. At first sight this may seem a large sum of money, but, after all, it is simply equivalent to the amount required to equip a single mine or build a modern battleship.* Is it too much to ask that the richest mineral State in all the world should allocate one-thirtieth part of her annual gold production for the endowment of a national college of agriculture?

Such a college would provide a sound training in agricultural science; would establish a research department for the investigation of those great problems which daily affect the agricultural industry; would conduct extension work in the field; would institute short practical courses for the farmer; reading unions for his wife; nature study clubs for his children; and correspondence classes for the teachers in country schools. Such, in short, is the legitimate field of the modern agricultural college.

Is it too much to maintain that such an institution would touch the heart of every home, and would effect a profound transformation in the rural life of this Colony within the space of a single generation?

* * * *

Four years ago Sir Percy Fitzpatrick brought forward a motion in the Transvaal Legislative Council to allocate the profits which might accrue to the State from the diamond industry as a permanent agricultural endowment. Unfortunately, at that time, the majority of his fellow legislators regarded this proposal as an impractical innovation, and so the matter was shelved for the time being. But it was only the other day that the Hon. the Colonial Secretary, General Smuts, in reference to another matter, is reputed to have said in his own happy phraseology: "We want the big thing." And the main question seems to us to be: "Do the farmers of the Transvaal want the 'big thing' in agricultural education?" For our own part we do not hesitate to say that we are totally opposed to any small or imperfect scheme which might result in the establishment of a parochial agricultural college—a type not unknown in England and elsewhere in Europe—indifferently staffed, and inadequately endowed, the peaceful retreat of idle, pleasure-loving youths. Lastly, it may be asked where should this college be placed. That is, certainly, a matter for Government to decide; but, in passing, we may remark that the people of this Colony have a chance of doing what neither the United States nor the Dominion of Canada has yet been able to do, namely, of erecting a great agricultural college in the close proximity of their Department of Agriculture, that is, in the Capital of the Transvaal: and if such a site be finally chosen, the question of the grounds or the campus of the college we may safely leave in the hands of our City Fathers.

* The Invincible a vessel of the Dreadnought type recently launched cost £1,927,000, while the price of equipping and developing a typical deep-level mine on the Rand is £1,288,900 approximately before any gold is won.

During the last session of Parliament the Right Hon. the Minister of Agriculture announced that it was his intention to establish a Statistical Division in connection with the Department of Agriculture, and we are glad to state that an immediate start has been made by the appointment of Mr. Gideon Frederik Joubert to the responsible post of Agricultural Statistician. Mr. Joubert, who comes from a family widely and honourably known in the annals of South African history, was born at Graaff-Reinet in the year 1859. Educated at Stellenbosch, he trekked with the northern movement into the Transvaal in 1885, and, after some years in the Civil Service of the Republic, he was appointed Magistrate at Ermelo, and, later, transferred to Lydenburg. After the war Mr. Joubert took a farm at Aliwal North, and, more recently, was appointed Secretary to the Pretoria Agricultural Union. It will thus be seen that Mr. Joubert has always been closely associated with the farming industry, and we do not doubt that his wide experience will prove of much value to the Department of Agriculture and the agricultural community of the Transvaal.

* * * *

But we cannot too strongly emphasise the fact that the success of the Statistical Division will mainly depend upon the earnestness and exactitude with which the farmers themselves render an account of the number of their flocks, their herds, and their crops. The Government has established this Bureau solely to help the farmers, and to be able to say at any moment whether this or that branch of agriculture is languishing or prospering. The Bureau, therefore, is really the pulse of the agricultural industry, by means of which the Department will be able to tell whether all is right with the rural patient: and we certainly shall not be worthy of the name of progressive agriculturists until we can definitely state how many sheep we have in Ermelo, how much tobacco we grow in Rustenburg, and how many citrus trees we have planted in Waterberg.

* * * *

Now this knowledge cannot be won in a day, but only by the patient, painstaking effort of every individual farmer. We have more than once referred to the magnificent Statistical Division of the United States Department of Agriculture, which is the admiration of the world; but the historical student can turn to the year 1863—just after the Department had been established—and read what the first Commissioner of Agriculture, the Hon. Isaac Newton, had then to say in pleading for a proper appropriation for this work:—

"Too much cannot be said in favour of agricultural statistics. They form the key which is to unlock the hidden treasures of maturing nature, or the chart which is to reveal to the husbandman and merchant the great laws of demand and supply—of tillage and barter—thus enabling both to work out a safe and healthy prosperity. Indeed, there is no logic so irresistible as the logic of statistics, and, in this country, those relating to agriculture are of the highest importance; and I am convinced when the agricultural statistics of the United States are properly collected and arranged, and thoroughly studied by our people, no other argument will be necessary to stimulate our farmers to higher excellence or to induce our statesmen to give to agriculture all possible legislative aid."

Our readers will be interested to learn that Mr. Vincent Bossley has returned from his Australian tour bringing with him some specially selected rams and ewes for the Government Stud Sheep Farm at Ermelo. The importations of Tasmanian sheep from Australia, recently purchased by the Department of Agriculture, were mainly secured at the annual stud sheep sales in Sydney and Melbourne. They consist of the highest class ewes and rams placed on those markets. Among the rams which have been purchased the most famous is "Bandmaster 2nd." This well-known animal has done duty at the Eskvale Stud for two seasons, and his class is shown by the fact that, besides securing the fine wool championship at the Sydney Sheep Show, several of his sons brought from 100 guineas to 300 guineas each at the different sales. Several of the other rams secured various honours at Campbelltown, Tasmania, in the fine wool sections. Amongst the ewes there are several prize-winners. This consignment was selected from the following well-known flocks: Eskvale, Bellevue, Fairfield, Scone, Rhodes, Winton in Tasmania, and Zara in Riverina, New South Wales.

Mr. Bossley states that the Tasmanian breeders have discovered that hay made from Italian rye grass is by far the most satisfactory fodder for sheep as it seems to promote an even flow of yoke in the wool through all seasons of the year. This crop is now extensively cultivated in Tasmania in conjunction with Cape barley as green feed. Indeed, the Tasmanians go so far as to avoid Australian fodder while their sheep are awaiting sale on the mainland. A pleasing feature of the stud sheep sales in Sydney are the neatly pressed bales of Italian rye grass hay, showing how the Australian flockmaster recognises the importance of good fodder. This leads us to remark that many of the ailments from which sheep suffer in the Transvaal are caused by a too monotonous diet, and until our sheep-owners are able to give their animals a little green food now or then, or, better still, to entirely change their grazing grounds, they will always be liable to such troubles as indigestion and internal inflammation, which can often be entirely cured by a simple change of diet.

* * * *

At the last rose and flower show in Pretoria we were struck with the beauty of some carnations grown by Mrs. E. P. Niemeyer, of Brooklyn. Pretoria has long been famous for its wealth of roses, but it is most gratifying to observe that the flower which many people place next to the rose, and some even before it, also responds in a remarkable manner to a little care and attention. Carnation growing is an industry specially adapted to those who have small gardens, and there is no doubt that a cut flower industry will arise, in due season, in the great centres of South Africa. To illustrate how quickly an absolute novice can become, with industry and intelligence, proficient in this branch of floriculture, we may cite the career of Mr. C. W. Ward, of New York, the most famous grower of carnations in the United States. For many years Mr. Ward was engaged in business pursuits, in fact, until his health gave way. Broken in physique, and in comparative poverty, he was walking along Broadway one morning when a Greek pedler thrust a bunch of

miserable carnations right into his face. And the thought struck him "why should not I grow better and more beautiful flowers." Straightway he went home, bought a few slips, and started to grow carnations. In less than ten years he was the most celebrated grower in America, being the originator of many new varieties, and the owner of twenty-six glass-houses given up altogether to carnation growing, having an output of over one million blooms.

Now, although we cannot all have acres of land and glass under carnations, we can at least have a square foot or two. Professor Bailey, of Cornell, somewhere says that one man may do more good with a cracked flower-pot in a tenement window than another with a thousand acres of land. Just now the whole of South Africa is eagerly discussing the great question of Union, and we may well recall the words of the Father of Australian Federation, Sir Henry Parkes, who said at the opening of the School of Arts at Manly: "There is no home in all this land, be it built of slabs or even sheets of bark, that might not be rendered more beautiful, more attractive, or more endearing by the simple act of planting a few flowers around it; and there is no person so poor or destitute of resources that he cannot brighten and enliven his dwelling in this way." So spoke the Colonial statesman who had known bitter poverty, had never been at school for more than three months on end, and, poor and friendless, had been glad to find a sixpence on the streets of Sydney to save him from starvation.

* * *

It is with much pleasure that we call attention to a new agricultural periodical which has just been issued, viz., "The South African Agriculturist and Stock Breeder." This paper, which is designed to cover the agricultural life of that vast territory which extends from the Cape to the Zambesi, will meet a real and practical need, and will doubtless prove a most popular monthly magazine. The editors of the "Agriculturist"—Mr. F. T. Nicholson, Secretary to the Transvaal Agricultural Union, and Mr. Matt Lochhead—deserve to be heartily congratulated on the issue of their first number, which is admirably conceived, well illustrated, and clearly printed. The publication of this paper is really a most heartening sign of returning prosperity, and we hope that all Transvaal farmers will support the effort of the enterprising publishers. The subscription to the "Agriculturist and Stockbreeder" is the modest sum of 6s. per annum, payable in advance either to the Head Office, 236 Vermeulen Street, Pretoria: or P.O. Box 6078, Johannesburg.

The Government Botanist, Mr. Burtt-Davy, writes: "Some surprise seems to have been felt in the Zoutpansberg District at the action of the Government in not disposing of the cotton crop grown last season on the Government Estate, Tzaneen, to the Zoutpansberg Cotton Syndicate. It should be explained that the British Cotton-growing Association, in order to stimulate cotton-growing in the Transvaal, supplied a certain amount of seed free of charge to the Government, but only on condition that the resulting crop was disposed of through

the Association. The crop in question was raised from seed supplied by the British Cotton-growing Association, and we were, therefore, under an obligation to dispose of the cotton through their agents and were not at liberty to deal directly with the Zoutpansberg Cotton Syndicate. In taking this course there was no intention on the part of the Department, or of the British Cotton-growing Association, to in any way disparage the work of the Zoutpansberg Cotton Syndicate; had it been possible to do so we should have been glad to have disposed of our crop through the agency of that syndicate."

With regard to the exportation of maize, the attention of the Railway Administration has been drawn to the fact that the bulk of grain for export has been bagged in 2¼ lb. bags, and it has been decided, in order not to inflict any hardship on the farming community, to accept 2¼ lb. bags from the 1st September for a period of six months. The 2¼ lb. bags will, however, only be accepted on the distinct understanding that they are new and double-sewn, and meet the requirements of the Railway Administration in every way. But, on and after the 1st March, 1909, only 2½ lb. bags will be accepted for export.

The Pretoria Branch of the South African National Union has adopted a useful method of carrying out its programme of work. Last August a small journal was started which has since developed into an interesting and timely publication, which is edited by the energetic Secretary, Mr. H. E. King. It is issued monthly from the office of the Union in Pretoria, and is sent gratis to any address on application. The purpose of the journal is to keep the public informed as to the progress of South African industry, to constantly remind them of the number of articles being produced, and to urge upon them that it is by the aid of the public themselves that the standard of excellence, where lacking, can be raised. The reader will find, in addition, articles and statistics, all bearing in some form on South African trade, which cannot fail to be of interest. A useful table is given in the December number showing the estimated population of South Africa, in which area, it is contended, there is a large field of enterprise open to the South African manufacturer in supplying the growing wants of over 11,000,000 white and coloured persons. But, in addition to this, an equally important work has been undertaken in the proposed establishment of a permanent industrial exhibition in Pretoria. The exhibition is primarily in the interests of the South African manufacturer, but the Department of Agriculture, other departments, and institutions are assisting, so that, besides providing an ocular demonstration of the progress being made in local manufacture, the exhibition should prove of considerable educative value.

The Government have contributed a grant of £250, but the material help of the public is still needed, and the Committee hope that the work of the Union, at both the Pretoria and Johannesburg branches, will be assisted by all those interested in the industrial progress of this country.

We are in receipt of the annual report of the Transvaal Land Owners' Association, which is an interesting and valuable survey of the agricultural operations of this Association, and which reflects great credit upon the President, Captain C. A. Madge, the members of the Committee, and their tireless Secretary, Mr. H. A. Baily.

With regard to the Government Stud and Experiment Farms the report says: "Your Committee believe that the value to the farming community generally of the work carried out at the various Experimental Farms is gradually being recognised by the rural population, and they trust that the result of this will reflect itself not only in improving the stock of the Colony, but will lead to more advanced methods of cultivation and in increasing the variety of products. They heartily approve of the decision of the Government to spend the sum of £12,000 sterling in the purchase of pedigree stock, and are pleased to note that 143 Tasmanian merino ewes and 5 rams of the best pedigree have just arrived safely from Australia for the Ermelo Stud Farm. At the same time it is difficult to understand why the Government continuously neglect the one industry so peculiarly indigenous to South Africa, viz., the farming of ostriches. The importance of this industry to the Cape Colony, where, last year, the value of the feathers exported realised over a million and a half sterling, is well known. As far back as March, 1905, your Association pressed the Government to establish an ostrich stud farm in the bushveld, and, as a result, £500 was placed on the estimates for that and subsequent years, but these amounts were never utilised. Thanks to the enterprise of certain private individuals, among whom may be mentioned the Honourable the Minister for Lands, and one of your members, certain initial work has been carried out in this direction, but the Government has done nothing to assist, and until the State takes the necessary step to foster the industry little progress can be expected." Confirmation of this—if such be needed—may be found in the last annual report of the Director of Agriculture, of which the following is an extract:—"Unfortunately the importation of live stock of all kinds, particularly the better bred ones, is an expensive and risky business *and quite beyond the reach of the average farmer, so the duty to assist breeders to obtain animals of the right stamp and at reasonable prices will fall upon the Government.* The best method of doing this will be to extend the system which has already been in operation upon the Experimental and Stud Farms since their establishment, and to maintain upon them a good number of high-class animals of the breed most likely to suit the country." Already a number of bushveld farmers are utilising the means at their disposal by farming the chicks of wild birds, but, as the domesticated bird produces far finer feathers than does the wild bird, it is evident our farmers are compelled to start operations at the initial stage where the Cape farmers started forty years ago, instead of commencing at the point reached by the Cape Colony to-day. In other words, our farmers are behind the times, and, as the Director of Agriculture so clearly points out, it rests with the Government to establish an ostrich stud farm where first-class domesticated birds may be obtained at a reasonable price. Pedigree Cape birds have lately sold for £1,000 per pair, a figure far beyond the means of the ordinary farmer. As showing the absolute necessity for our farmers adopting the most

up-to-date methods the following statistics of ostrich farming outside South Africa are significant. Twenty-six years ago ostriches were introduced into the United States, and, to-day, their stock numbers 2,200 birds. South Australia has over 1,000 birds, and one farm in Victoria alone has a troop of 100. In New Zealand the industry is as yet in its infancy, but already they have over 500 birds.

We are indebted to the Director of the Imperial Institute, Professor Wyndham R. Dunstan, M.A., F.R.S., for the following report on the operations of the Imperial Institute in connection with the Transvaal. After reviewing the work of the Scientific and Technical Departments, Professor Dunstan writes:—

"In 1906 space was allocated in the Public Galleries for the formation of a Transvaal Court contiguous to the courts of the other South African Colonies. A large wall map of the country was obtained, and statistical tables and diagrams illustrating the trade of the Colony and the progress of the mining industries were prepared. Only a few samples of Transvaal products were available at the time, but the collection has been somewhat increased by the addition of specimens forwarded to the South African Products Exhibition. The exhibits have been fully labelled, and, although incomplete, they form an interesting collection illustrative of the natural resources of the Transvaal. It would, however, enhance the value of the Court if further specimens could be forwarded, and, if desired, a list of the present requirements of the Court will be submitted.

"The Director of the Imperial Institute, at the request of the Colonial Office, represented the Transvaal on the Executive Committee of the South African Products Exhibition held in London last year, and the staff of the Imperial Institute rendered considerable assistance in the arrangement of the Transvaal exhibits. A large number of enquiries respecting the Transvaal and its resources were made by visitors to the collections, and 162 handbooks and pamphlets relating to the Colony were distributed to enquirers from the Central Stand in 1907."

In the *Journal* for October we published under the heading "Useful Facts and Figures for Farmers and Fruit Growers" an article entitled "Cures for Bots," a remedy recommended by the United States Department of Agriculture. Several correspondents have asked us what tansy is, where it can be obtained, and whether the salts mentioned mean Epsom salts. Regarding "tansy," Mr. Burtt-Davy, the Government Botanist, writes:—

"Tansy is a composite commonly grown in old English gardens. I have seen it as an 'escape' on a vacant erf in Carolina. Seed can be had from European seedsmen. Botanical name is *Tanacetum vulgare*."

In order to obtain information as to the proper dose to be given we have written direct to the Chief of the Bureau of Animal Industry, Department of Agriculture, Washington, D.C.

The fourth annual sale of Government live stock was held at the Experimental Farm on Saturday, the 28th November, 1908, in the presence of a large number of farmers from every district in the Colony. The day was perfect and the morning was spent by the visitors in examining the work of the different divisions and the various experiments which are now in progress.

Although the prices realised for cattle were not so high as last year, yet the average figure was most satisfactory and showed that there is a very good demand in the Transvaal for pedigree animals. The highest prices were paid for two Hereford bulls, one (the first prize winner at the last Witwatersrand Show) being sold to Mr. McLaren, of Vereeniging, for £78 15s., while the second prize winner at the same show was sold to Mr. Staunton, of Ermelo, for £77 14s. A parade of stock took place at 11.30. At luncheon the chair was occupied by the Hon. J. E. van der Merwe, and the company, which numbered about 400, included many ladies.

His Excellency the Acting Governor—Lord Methuen—spoke in an eloquent manner of the trials and difficulties which afflict the farmer in the Transvaal, reviewed the progress of the rural industry and emphasised the essential need of agricultural education. Speaking of live stock, Lord Methuen said: They had to be careful to see that nothing but the very best stock is brought into this Colony. They had to impress upon the farmer that, although farming might have been easier in former days, yet even with the facilities now given to him it was more difficult to make a livelihood. It was true that in those days he had not the same competition, and could go shooting and enjoying himself as well as getting a living out of his farm. But the day of the trek ox was passed. Whether it was the deterioration of their teeth or whether it was that their digestion was not so good as that of their forefathers, it was undoubtedly a fact they did not appreciate, as they had before, an ox that had done duty for a considerable number of years in front of a wagon, and which was now neither appreciated in life nor in death. (Laughter.) What the farmer must have ready for them now was a small, well-trimmed joint which gave a zest to the appetite. The farmer would also have to realise that he would not get the same price for this better-class meat as he got in the olden days for meat of inferior quality.

With regard to co-operation in supplying the Army, the Commander-in-Chief remarked: The next thing he came to was co-operation, which had been so ably dealt with by General Botha. He did not think any body of men were better customers for them than the Army. He also thoroughly appreciated the fact that much as they might like the Army a great deal of their love depended on the money they got out of the Army. (Laughter.) The Army was not allowed to buy more than 25 per cent. direct from the farmer —(a voice: "A pity")—but they had acted *ultra vires*, and had bought all the lucerne they could get from the farmers round Middelburg, Cape Colony, and a very large proportion of that grown round Potchefstroom. But what they found at Standerton was this—that it was perfectly impossible to deal with the farmer. The farmer would instruct them to arrange the purchase themselves, and would bring in his goods anyhow, and his tenders would be equal to those of

the contractor. He did not suppose there was any one listening to him who had any great sympathy for the middleman. No one had had more to do with the contractors than himself, and all he could say was that he had never found them living on air. (Laughter.)

What the farmers must do was what General Botha had told them—they must co-operate; they must build a store large enough to hold what the Army required for six months or so, so that the Army might feel that when they deal directly with the farmer they might have the same confidence that he would carry out his contract as, generally speaking, they had in the contractor. He was not finding fault with them for one moment for the energy they had displayed in getting rid of their mealies. Three days ago he had been told that the contractors had said to his officials that if they pressed for their contract for mealies, not only would the contractors be ruined, but the Army would lose their money. Therefore it was they were forced to write off their contract for mealies, and let the contractor supply them with oats, which were not the best produce in this Colony, until next April or May. When they realised that they sold their mealies at 8s. per bag, and could get 15s. 4d. per bag now in Johannesburg, with every chance of their rising to 25s. before next May, he asked them was that a sound policy? It was supposed that this place of all others had to give South Africa a lead in agriculture, and this was only to be attained by bringing the very best stock into the country and making the farmers understand that it was absolutely necessary that they should have nothing but the very best stock on their farms.

The fourth annual congress of the Inter-Colonial Agricultural Union of South Africa was held at Bloemfontein on the 25th and 26th of November. There was a good attendance from all the British Colonies, whilst the Province of Mozambique was represented by Mr. O. W. Barrett, the Director of Agriculture. Mr. C. G. Lee, the President of the Union, delivered a spirited address. He sketched the rapid evolution of South African agriculture, spoke of the need of new and improved methods, and pressed for the wider teaching of agricultural science. He also touched upon the educational influence of agricultural shows, and pleaded for the lowering of railroad rates in order to enable all farmers to attend.

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The congress was fully alive to the vast potentialities that lay in the wool trade, and most interesting points were raised. The Hon. A. G. Robertson, M.L.C., submitted figures which showed clearly that the quotations for South African wool, which came to us from the London market, were an untrue index of the actual average prices obtained. Out of hundreds of thousands of bales sent from South Africa, only some 37,000 found their way to the London market, and these were the balance of those that were snapped up by manufacturers in England, America, or the Continent, and that never were offered for public sale. Mr. W. J. Palmer, Director of Agriculture, O.R.C., substantiated this by stating that, when he

went to the London Wool Market, he was surprised to find that South African consignments were represented by a few ragged, dirty bales which lay in a corner of the vast shed unobserved and unsought after. Here we have food for reflection and for reconsidering our methods of forwarding our wool products to foreign markets. The lesson appears to be that wool is sold to local merchants at London prices—that is, the prices quoted as explained above—and the merchant's agent disposes of his consignment to private buyers or manufacturers. The one and only remedy is to co-operate and send consignments direct to the London market, so once again the moral is—co-operate.

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The question of the eradication of scab is a perennial one at such conferences, and, in this respect, it is gratifying to note that a great change is coming over the country. More stringent measures were advocated, and it was thought that the time for education was now past, and that only compulsory measures should now avail. Respecting locusts, there was again marked unanimity. The work of the locust bureau was eulogised, and the Governments were asked to continue the useful work of the bureau.

East Coast fever held the attention of the delegates for a considerable time. A suggestion was made that the various Governments should combine and offer a substantial reward to the person who should discover a preventive or cure for this disease, while Mr. F. T. Nicholson brought forward a motion to the effect that the various Governments should equip a central laboratory and employ one, two, or three men to devote their whole time to scientific research in this direction. Altogether, the work of the congress was most successful, and the delegates may congratulate themselves that they accomplished so much in the limited time at their disposal. The Hon. A. G. Robertson, M.L.C., was elected President of the Union for the forthcoming year, and Mr. F. T. Nicholson, Secretary.

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In a telegram dated Wellington, November 5th, which appeared in the London *Times*, the following appeared:—

"Referring to the State's activity on behalf of the farmers, the Prime Minister stated that no other country, except Hungary, showed so large a public expenditure on the development of agriculture. In 1901 this amounted to 2s. 2d. per head; now it stood at 3s. per head, which was more than that in any other country of the world."

In a letter addressed to Sir Joseph Ward, K.C.M.G., Prime Minister of the Dominion of New Zealand, we pointed out that the public expenditure on agriculture by the Government of the Transvaal at the present moment stands at 13s. per head of the white or European population. Consequently, this Colony is entitled to be placed before all countries in this regard.

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As we have published in the Correspondence Column of this issue a remedy for destroying rats by means of virus, we think it right to insert a paragraph extracted from the London *Times*, and entitled "Dangerous Poisons for Vermin." It runs as follows:—

"Dr. Collingridge, the medical officer of health for the City of London,

reports an outbreak of illness in a business establishment where a large number of persons of each sex are employed. Twelve men became seriously ill, but all recovered in a week. All the persons affected had dined in the same room, whereas those who had dined in four other rooms had not suffered. When the boards of the room were removed a large number of dead and decomposed mice were found. It was ascertained that some of a much-advertised virus had been laid about the room and pantry. The virus was said to be harmless to human beings and domestic animals; but it was conclusively proved that it had caused the illness in question.

"The virus, it is pointed out, was laid about on pieces of bread, and it was easy to conceive that mice, after eating the virus, might carry the contagion about on their feet to tables and places, and thus it could infect human beings dining in the room."

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It is with regret that we have to announce that *Phylloxera vastatrix* has been found by the Plant Pathologist and the Horticulturist in one of the vineyards belonging to Mr. S. Marks, Zwart Koppies, Hatherley. This, so far as we are aware, is the first time that this dreaded pest has been observed in the Transvaal, and intending growers are warned not to plant vines on a large scale except those which are planted on Phylloxera-proof stocks.

* * * *

The Agent-General for the Transvaal—Sir Richard Solomon, K.C.B.—has forwarded us a memo in regard to a new machine which is specially designed for the Colonies, and which might prove of use to our farmers. In a letter the agent for this machine writes as follows:—

"Joel's Export Mill, of which I beg to submit particulars herewith, is at present the *only* machine which enables the farmer to produce the flour required for his own household, on *his own farm*, making him independent of any mill to which he hitherto had to cart his grain to be ground at a loss of time and expense. The same machine serves equally well for preparing other grain than wheat to be used as food for cattle, poultry, etc., and takes the place of other machines for the purpose. Although new, this machine has rapidly been taken up in wheat-growing countries abroad, like Chili, Argentine, Brazil, the German Colonies of South Africa, India and China, proving its undoubted value as a machine for colonial farms, and I am confident that it will find the same favour in your Colony."

The manufacturer is Alfred Joel, Zurich, Switzerland, and the agent Alph. Steiger, M.I.C.E., 28 Victoria Street, Westminster, S.W.

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The following is a list of agricultural shows to be held in the Transvaal, 1909:—

Lydenburg: Last week in January (day to be fixed).
Ermelo: First week in February (day to be fixed).
Bethal: Second week in February (day to be fixed).
Carolina: 10th March.
Wakkerstroom: 24th and 25th February.
Middelburg: First week in March (day to be fixed).

Waterberg: Second week in March (day to be fixed).
Standerton: 24th March.
Pretoria: 1st, 2nd, and 3rd April.
Heidelberg: 7th April.
Witwatersrand: 14th to 17th April.
Klerksdorp: No show.
Wolmaransstad: 5th May.
Barberton: July (day to be fixed).
Marico: Not fixed.

It is understood that Potchefstroom and Pietersburg do not intend to hold shows during 1909.

Messrs. Buxton, Ronald & Co., wool brokers, London, write under date 14th November, 1908:—

"We are pleased to be able to report that markets seem to have taken a turn for the better, and both fine and coarse wools are in much better request than a month ago. Whether this improvement forbodes a still better state of affairs in the near future time alone can show, but stocks everywhere are light, and, if no outside influences get to work it seems quite probable that the new year may see a higher range of values."

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Mr. C. W. Howard, Chief of the Entomological Section, Department of Agriculture, Lourenço Marques, writes us as follows:—

"I find that several Transvaal nurserymen are sending down plants and trees to this Province in ignorance of the fact that a permit is necessary first. I think it would be advisable if you could see your way to noting our regulations in the *Journal*. This might save some of them some trouble in the future."

We would advise all nurserymen and others interested in this matter to write to Mr. Howard for a copy of the regulations relating to vegetable sanitation in the Province of Mozambique.

Farmers in the Transvaal will be interested to learn that part of the vote of £12,000 for the purchase of pedigree stock for the Government Stud and Experimental Farms has been used for the purchase of the following animals for the Potchefstroom and Standerton Farms:—

FOR THE EXPERIMENTAL FARM, POTCHEFSTROOM.

Cattle:—

Hereford bull (two years old), "Noke Gallant," by "Gilderoy" out of "Doris," bred by Mr. H. R. Evans, Pembridge, Herefordshire. This bull was a prize-winner at the 1908 Leominster show.

Lincoln red bull (one and a half years old), "Stenigot Bloom Boy II," by that famous sire "Ashby Red 2nd," and out of a deep milking cow "Stenigot Bloom IV." This bull has a famous record, being unbeaten as a yearling in 1908 at the English shows, including the Royal and Lincoln County. He was bred by Mr. Richard Chatterton, Stenigot.

Two Friesch bulls, "Theunis" (two years old), and "Klaas" yearling). Both bulls are out of heavy milking cows, and are by the same sire "Albert," one of the most famous stud bulls in Holland. "Theunis" was a first prize-winner at the Leeuwarden show in 1908. "Theunis" was procured from R. Seinstra, Oudkerk, and "Klaas" from J. W. Sikma, Oudkerk.

Twenty-three Friesch cows and heifers, all selected from the best herds in Friesland and South Holland; among others are the well-known breeders, K. N. Kuperus & Son, Marssum; Firma Schaap, Deersum; M. Veeman, Marssum; W. B. Bruinsma, Wirdum; W. D. Wassenaar, Jelsum. Black predominates in colour, and special care has been taken to get animals with plenty of substance and constitution for the trying climate of this Colony.

Six Sussex cows and heifers, including "Tilsden Jessie," champion Sussex female in England in 1908, bred by the Honourable Ralph Neville, Birling Court, Maidstone, and Mr. W. F. Winch, Cranbrook, Kent.

Sheep: —

Thirty-five Suffolk Down shearling ewes and twenty-five ram lambs, twenty-three of which will be disposed of at the annual sale of pedigree stock; one Shropshire ram and one Oxford Down ram (presented by J. T. Hobbs, Esq.)

Pigs: —

One Berkshire boar from the herd of Mr. R. W. Hudson, Danesfield, and two Berkshire sows (prize-winners at the Royal show) from the herd of the executors of the late Colonel McCalmont; one large black boar from the herd of W. Wills, Talfield; and two large black sows from Mr. Wm. Knight, Wintringham Hall, St. Neots. All these large blacks were prize-winners at the Royal show.

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FOR THE STUD FARM, STANDERTON.

Cattle: —

Twenty-one shorthorn (Coates) heifers in calf, purchased from the herds of such well-known breeders as Sir Richard Cooper, Bart., Shenstone; Capt. Harrison, Lichfield; Geo. Harrison, Darlington; J. T. Hobbs, Maiseyhampton; Richard Chatterton, Stenigot.

Sheep: —

Fifty Suffolk Down ewes and two rams.

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These stock were personally selected and shipped by Mr. Alex. Holm, General Manager, Experimental Farm, Potchefstroom, during his recent visit to Britain and Holland, and, along with them, he also shipped the following pedigree stock for private breeders in the Transvaal: —

For Mr. L. Bagshawe Smith, Harrisburg.—

One two-year-old red Lincoln bull, "King's Cowslip," bred by Mr. Richard Chatterton, Stenigot, and also by the famous stud bull "Ashby Red 2nd," out of a deep milking cow; four Lincoln red heifers from the herds of Mr. J. Burtt, Welborn, Lincoln, and

Richard Chatterton, Stenigot. These are undoubtedly some of the best Lincoln reds ever imported to South Africa.

For A. H. R. Langermann, Familie Hoek, Ermelo.—

Two first-class Friesch heifers in calf from the herds of M. Veeman, Marssum, and Alle Bakker, Ranwerd.

For Thos. Everard, Carolina.—

One Welsh bull, "Madryn Mallard," from the University College herd, Bangor, and a frequent prize-winner at Welsh shows.

For Mr. S. Marks, Pretoria.—

Six Suffold Down rams.

The whole consignment, consisting of 66 cattle, 120 sheep, and 6 pigs, was shipped by the Union-Castle s.s. *Susquehana*, and only one death took place on the voyage, viz., that of a shorthorn heifer. It is noteworthy that this is the first animal of the cattle kind which the Department has lost en route in the last five years, during which large numbers have been imported. Special and most satisfactory arrangements were made by the Union-Castle Company for this consignment. Importers of pedigree stock will be interested to know that the "Conference" Lines have recently agreed to a sliding scale of rates for live stock exported from Britain to South African ports, i.e. the larger the number of animals sent in one consignment the lower are the charges per head. The rates are now reasonable, and will be a help towards encouraging the importation of stock.

Mr. Alfred Webb, produce agent, P.O. Box 2342, of Johannesburg, has kindly sent us a note on the Johannesburg market during the past three months:—"At the beginning of last quarter, and for some time thereafter, the cattle market was characterised by an exceeding shortage in the supply of prime beef. The consequence was that, at one time, prices for best quality touched the neighbourhood of 45s. per 100 lbs. on a dressed basis. This high price was maintained more or less throughout October and the beginning of November, but, towards the end of this latter month, prices fell to 40s., and, at the time of writing, the market has dropped still further.

"It is difficult to gauge the immediate future of the beef market, but, from appearances, the prospect is not encouraging to farmers. For this reason it is essential that only best quality be forwarded for some time to come, as medium and poor classes are not wanted and fetch low prices.

"The importation of killed meat from Natal and certain districts in the Transvaal, where precautionary measures are being taken against tick fever, is no doubt largely responsible for the present condition of the beef market.

"*Sheep.*—Special prime quality has fetched excellent prices until the last week or so, but now the summer rush has begun it is anticipated that prices will fall. Consignors invariably make the mistake of endeavouring to squeeze in poor or medium class stock amongst good quality, in the hope of obtaining extra profit thereby. But no greater mistake could be made, as the buyers on the Rand are not to be deceived by practices of this kind (being the keenest in South Africa), and the price of the good stock suffers accordingly.

"The farmer who pays the same attention to grading his stock as he does to his wool will always obtain a better proportionate return for his trouble and honesty.

"Complaints are rife throughout South Africa that the Johannesburg market is the worst in South Africa to send stock to, but the fault is largely due to the unbusinesslike methods of consignors. It is highly inadvisable to forward stock to this market before communicating with some reliable agent as to the conditions prevailing from time to time. Indiscriminate forwarding is to be deprecated from all points of view. Further, many farmers make the mistake of sending stock over long distances in uncovered trucks. The consequence is that after several days' journey in the heat, cold, or rain the stock arrives in such a condition as to look quite different animals to those when trucked. Prices, especially during the period under review, ruled from 5d. per lb. to 6d. per lb. upon a dressed basis. At the moment of writing the market is weaker, and is likely now to remain so. Pigs have come forward in considerable quantities, and rates have ruled from 3d. to 4d. per lb. live weight. At the moment only very best quality fetches the latter price, and values are likely to go rather lower than otherwise. Well-bred, fat, prime quality pigs weighing from 50 lbs. to 90 lbs. are most in demand, and continuous consignments of this quality may be forwarded. Rough, Kaffir pigs are not wanted, nor very large sized pigs, as prices for this class range from 2½d. per lb. to 3¼d. per lb. In the ordinary way there is no demand in Johannesburg for breeding stock, as this market requires only the best quality slaughter stock. Breeding stock, therefore, should not be forwarded under any circumstances unless special orders have been obtained through an agent beforehand. If this advice is neglected consignors will invariably experience disappointment and heavy loss."

We shall always be glad to report in the pages of this journal the success of any Transvaal youth in agricultural science, and so it is with pleasure that we learn of the honourable place taken by Mr. F. T. Nicholson, jun., son of the indefatigable Secretary of the Transvaal Agricultural Union, in the Government School of Agriculture at Cedara. This lad, who, by the way, is only sixteen years of age, has taken a first prize in dairying and milking open to the whole school, while, in his own year, he has been placed first in Agricultural Botany and second in Animal Husbandry. We cordially congratulate Mr. Nicholson, jun., on the prizes he has won so early in his career, and we trust that he may be able to supplement his South African training at one or other of the great American agricultural colleges.

A copy of the evidence of Mr. Van Leenhoff, Chief of the Tobacco Division, given before the Select Tobacco Committee of the Orange River Colony Parliament, has just reached us. We regret that, owing to the delay in receiving this memorandum, we can merely mention it in the current issue. But we would advise all tobacco farmers who are interested in this matter to communicate direct with Mr. Van Leenhoff, P.O. Box 434, Pretoria, who will be glad to furnish copies of these minutes.

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On page 145 of the October number of the *Agricultural Journal* we called attention to an instance of excessive freight on a consignment of box material for the use of the Rustenburg Co-operative Fruit Growers' Association, which cost £51, and upon which a charge of £37 16s. 10d. for freight was levied. This matter has now been investigated by the General Manager of the Central South African Railways, who finds that the charges complained of were due solely to remissness on the part of the consignor when handing over the consignment at Harden Heights.

Arrangements are now in progress to make a refund of the excess paid. It is therefore plain that the C.S.A.R. authorities are in no way to blame for the regrettable excess charged, and we therefore take this opportunity, in the name of our farmers, of thanking the railroad administration for so promptly clearing up this matter.

Agricultural Notices.

Veterinary Division.

ARRANGEMENTS FOR FORWARDING PATHOLOGICAL SPECIMENS.

It is hereby notified for general information that special arrangements have been made with the Central South African Railways for forwarding pathological specimens for examination in the Veterinary Bacteriological Laboratory, and all such specimens can now be sent carriage forward, if addressed to the Government Veterinary Bacteriologist, Pretoria Station, and distinctly labelled "Scientific Specimens for Examination." The Government Veterinary Bacteriologist is at all times glad to make examinations and to report on pathological specimens, but farmers and others sending such are earnestly requested to write full particulars of the animal from which the specimen has been taken and to post such in time to be delivered before the arrival of the specimen, or, in case of urgency, to telegraph. The importance of doing this is urged, since occasionally, when not previously advised, specimens have arrived in too decomposed a condition for examination.

F. B. SMITH,
Director of Agriculture.

Office of the Director of Agriculture,
1st October, 1907.

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SPONZIEKTE OR QUARTER EVIL.

Vaccine for the prevention of this disease can be obtained through the Government Veterinary Surgeons, who will give instruction in the method of vaccination, and through whom also the necessary instruments can be obtained. The price of the vaccine is 3d. per double dose.

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PORTS FOR ENTRY OF STOCK.

The following are the ports for entry of stock into this Colony from the neighbouring territories:—

	Days on which open for the examination of Stock.
Vereeniging	Daily.
Volksrust	"
Villiers Drift	"
Christiana	"
Roberts Drift	Thursdays, Fridays, and Saturdays.
Schoemans Drift	Mondays and Thursdays.
Buhrmans Drift	Saturdays.
Fourteen Streams	Wednesdays.
Coal Mine Drift	Thursdays.
Mosymiani	Saturdays.
De Langes Drift	Tuesdays.
Commando Drift	Alternate Wednesdays.
Komati Poort, through which stock not provided for under Clause 5, Government Notice No. 834 of 1903, will only be allowed to proceed by rail, to be examined at Machadodorp	Portuguese East Africa.

Division of Botany.

INJURIOUS WEEDS.

Owing to the fact that of late several newly-introduced and injurious weeds have made their appearance in the Transvaal, farmers are earnestly requested to take careful notice of any new plants which have appeared on their farms and which seem to have a tendency to spread. When such are discovered, specimens of the plant bearing flowers and, if possible, fruit should be forwarded to the Government Botanist by whom they will be examined and reported upon. They should be forwarded in the same way as specimens of poisonous plants.

COCKLE-BURR.

On account of the dangerous character of this weed to wool and mohair growers, farmers on the Aapies, Pienaars, and Crocodile Rivers are advised to keep a sharp look-out for its appearance, especially on the banks of the rivers, and to root out the plants before they scatter seed. Any farmer who is in doubt as to the identity of Cockle-Burr can send specimens to the Botanist for identification.

Division of Forestry.

SALE OF HEDGING FROM IRENE NURSERY.

It is hereby notified for general information that the sale of Hedge Plants from Irene Government Nursery has been discontinued. Forest trees will be disposed of as formerly.

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The price list of seeds and trees supplied by this Division can be obtained free of charge on application to the Conservator of Forests or the Government Printer, Pretoria.

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Farmers' Bulletin No. 8, "The Propagation of Trees from Seed," can now be obtained, free of charge, on application to the Government Printer.

Chemistry Division.

INSTRUCTIONS FOR THE SAMPLING OF SOILS.

There are many ways of taking samples of soil. The following, perhaps, will be found most convenient in this country:—

(1) Having selected a representative spot, the vegetation upon it is removed, and a hole is dug with a sharp spade to a depth of about 15 inches. One side of the hole is then trimmed with the spade so as to be smooth and vertical, the hole being cleaned out. A slice of uniform thickness, about 3 or 4 inches, is then removed by the spade down to the depth of one foot. This slice is placed on a clean board or sack and mixed with similar slices, obtained in the same way from other parts of the field. Finally, all the samples are thoroughly mixed together with a trowel or the spade, the sticks, large stones, and roots removed, and a portion of 6 or 7 lbs. placed, with a label giving details, in a clean bag or box and sent for analysis.

(2) Another, better but more laborious, method is to have wooden boxes, 6 inches square and 12 inches deep, to hold the samples. A large hole is dug with a spade at the selected spot, and a square upright block of soil is left in its centre. This is carefully trimmed with the spade until a box will just fit over it. The upper surface of the block of soil is freed from vegetation, the box inverted over it, and forced down. The spade is next slipped under, and the box with its contents removed, a label giving particulars of the soil put in, and the lid screwed on. In this way a sample of the soil (and often the sub-soil *in situ*) is obtained which can be examined in the laboratory.

WHAT TO DO WITH THE SAMPLES.

In all cases full details as to the exact locality, date of collection, depth, crops borne, previous manurial treatment, and other circumstances connected with the soil should be enclosed with the sample. These should be written in pencil, as ink is apt to become damp and run.

Samples should be sent by passenger rail, addressed to the Chief Chemist, the Agricultural Chemical Laboratories, Pretorius Street, Pretoria, and advice of their despatch, together with details of the samples, should be sent by post to the same address.

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SCHEDULE OF CHARGES FOR ANALYSIS MADE IN THE AGRICULTURAL LABORATORIES.

	£	s.	d.
1. Estimation of one constituent in a manure or feeding stuff	0	7	6
2. Estimation of two or three constituents in a manure or feeding stuff..	0	15	0
3. Complete analysis and valuation of a manure or feeding stuff ..	1	0	0
4. Analysis of water—drainage or irrigation	1	5	0
5. Partial analysis of a soil to determine fertility and manurial needs ..	2	0	0
6. Complete analysis of a soil	3	0	0
7. Analysis of milk, cream, butter, or cheese..	0	10	0
8. Milk—determination of fat and total solids	0	5	0
9. Milk—determination of fat only	0	2	6
10. Butter—determination of water and fat	0	5	0
11. Analysis of a vegetable product—hay, ensilage, roots, etc.	1	0	0

At present no charge will be made to bona-fide farmers. The charges in the above schedule refer to products sent by manure merchants, milk dealers, or others interested in trade. Samples will only be accepted if assurance can be given that they are properly taken and truly representative of the bulk. The right of publishing the results of any analysis is reserved by the Department. Should the examination of any product furnish results which are deemed of sufficient general interest, the charges may be remitted.

Samples of any product likely to be of agricultural importance will gladly be received.

Division of Horticulture.

CONTINUATION OF NURSERY WORK BY THE HORTICULTURAL DIVISION.

The present opportunity is taken of notifying farmers generally that the propagation of young fruit trees for sale at the various Experimental Orchards and Nurseries of this Division will be recommenced immediately, but trees will not be available for disposal until July, 1909. By this date it is expected that a good number of trees will be available, and they will comprise such varieties as have proved to be suitable for the various districts of the Transvaal by actual test at the different Experiment Stations.

* * * *

SALE OF FRUIT TREES, VINES, CUTTINGS, SCIONS, Etc.

It is notified for public information that in future payment must be made for goods on or before delivery. When purchasers mention a railway station to which packages may be consigned for them, advantage may be taken of the "Collect on Delivery" system of the C.S.A.R. In all other cases cash should accompany the order, but it is advisable prior to remitting same that enquiries be made of the Government Horticulturist as to the ability of the Division to supply the trees ordered.

Experimental Farm, Potchefstroom.

PIGS FOR DISPOSAL.

Pure-bred boars and sows (4 to 5 months old) of the Large Black, Berkshire, and Large White Yorkshire breeds will be ready for disposal in March. Prices 60s. to 80s. each, according to quality.

SEEDS FOR DISPOSAL.

Potatoes.

Limited quantities of the following early varieties. May Queen, Early Rose, and Epicure, from crop raised in December, are expected to be ready for planting in February. This seed is only recommended for warm districts. Price 15s. per bag of 150 lbs f.o.r. Potchefstroom.

Wheat.

Price 12s. 6d. per 100 lbs f.o.r. Potchefstroom. Early and Medium Early varieties suitable for irrigated land :- Potchefstroom White, Fourie, Eksteen, Klein Koren, Bombay, Glujas Early, Caledon Baard, Bob's Rust Proof, Holstrooi, Spring, Rooibaard, Australian (early); other varieties can be obtained in small quantities. Late varieties, such as Red Fife, New Era, Talavera, and others, probably valuable on high veld for winter feed for sheep and crop to mature about December. Should be sown in February and March for this purpose.

Barley.

Price 12s. 6d. per 100 lbs f.o.r. Potchefstroom. Several varieties for malting purposes.

Note. -These are still somewhat experimental.

Rye.

Price 12s. 6d. per 100 lbs f.o.r. Potchefstroom Early and Late (winter) varieties. Early Rye strongly recommended for green forage purposes.

Oats.

Price 10s. per 100 lbs. f.o.r. Potchefstroom. White Egyptian, Algerian (1907), and Boer.

All the above prices are subject to alteration without notice.

These seeds consist of different varieties which have been experimented upon at this farm, and have proved valuable ; the crops thereof have been specially grown for seed purposes.

The amount of seed which will be issued to any one farmer will be determined by the amount available and the applications received.

Orders must be accompanied by cheque or postal order, and the seeds will be allotted according to priority of application.

For full particulars and any other information apply to the General Manager, Experimental Farm, Potchefstroom.

Poultry Division.

STOCK BIRDS FOR SALE.

A large number of young stock of the following breeds are for disposal—
Anconas, cockerels and pullets, 12s. 6d. and 15s. each.
Brown Leghorns, cockerels and pullets, 12s. 6d. and 15s. each.
White Leghorns, cockerels (pullets not yet ready), 10s. to 15s. each.
Black Leghorns, cockerels and pullets, 10s. to 15s. each.
Minorcas, cockerels and pullets, 15s. each.
Buff Orpingtons, cockerels and pullets, 10s. to 15s. each.
White Orpingtons, cockerels only, 12s. 6d. to 15s. each.
Indian Game, cockerels and pullets, 12s. 6d. to 15s. each.
White Wyandottes, cockerels and pullets, 12s. 6d. to 15s. each.
Silver Wyandottes, cockerels and pullets, 12s. 6d. to 15s. each.

All prices f.o.r. Potchefstroom.

Young Pekin ducks and drakes will be available by 1st March, price 12s. 6d. to 15s. each.

All the breeding pens having been broken up, no settings of eggs are available.

For further particulars and information apply—

R. BOURLAY, GOVERNMENT POULTRY, EXPERT.

Experimental Farm, Potchefstroom.

Stud Farm, Standerton.

In view of the possibility of the introduction of contagious diseases the Rt. Hon. the Minister of Agriculture has decided that, in future, no more animals will be received from the public upon any of the Experimental or Stud Farms for stud purposes.

Editorial Division.

AVAILABLE PUBLICATIONS.

The following publications can be had, free of charge, on application to the Government Printer, Box 373, Pretoria :—

Transvaal Agricultural Journal,	No. 3,	Vol. I	(Published quarterly.)
,, ,, ,,	No. 4,	Vol. I	,, ,,
,, ,, ,,	No. 13,	Vol. IV	,, ,,
,, ,, ,,	No. 14,	Vol. IV	,, ,,
,, ,, ,,	No. 15,	Vol. IV	,, ,,
,, ,, ,,	No. 16,	Vol. IV	,, ,,
,, ,, ,,	No. 21,	Vol. VI	,, ,,
,, ,, ,,	No. 22,	Vol. VI	,, ,,
,, ,, ,,	No. 23,	Vol. VI	,, ,,

Division of Botany :—

Leaflet No. 1.—"Plants Poisonous to Stock."
,, No. 4.—"The Cockle-Burr."
,, No. 6.—"Peach Leaf Curl."
Bulletin No. 1.—"The Conditions of Seed and Plant Distribution," 1906-07.
Bulletin No. 2.—"The Conditions of Seed and Plant Distribution," 1907-08.
Circular No. 1.—"Poisonous Plants."

Division of Entomology :—

Leaflet No. 1.—"Cut Worms."
,, No. 5.—"The Fowl Tick."
,, No. 6.—"Cockchafers and Flower Beetles."
,, No. 7.—"Sprays for Locust Destruction,"
,, No. 10.—"Notes on Termites."
,, No. 11.—"The Scale Insects of Citrus Trees."

Division of Forestry :—

"Price List of Seeds and Trees."

Division of Horticulture :—

Bulletin No. 1.—"Some Information about Fruit Trees."
Leaflet No. 3.—"A Fruit Report."
,, No. 4.—"Diseases of Orange Trees."

Division of Dairying :—

Circular No. 1.—"Breakfast Cheese."
" No. 2.—"Rennet Making."
" No. 4.—"Treatment of Milk."
Farmers' Leaflet No. 1.—"Buttermaking."
" " No. 2.—"Making of Edam Cheese."

Division of Veterinary Science :—

Bulletin No. 1.—"Measles in Swine and Cattle."
" No. 6.—"Contagious Abortion."
Leaflet No. 3.—"Rhodesian Tick Fever."
" No. 5.—"Glanders and Farcy."
" No. 4.—"Directions for Preparing Blood Smears."
" No. 6.—"Wire Worms."

Division of Publications :—

Bulletin No. 1.—"Burrweed or Boete Bosch."
" No. 2.—"Some Diseases of the Horse."
" No. 3.—"The Food of Plants."
" No. 6.—"City and Town Milk Supply and the Care and Aeration of Milk.

Farmers' Bulletins :—

Farmers' Bulletin No. 1.—"Maize Foods for the Home."
" " No. 2.—"Notes on Tobacco."
" " No. 3.—"Notes on Lucerne Growing."
" " No. 4.—"Smut in Wheat, Barley, and Oats."
" " No. 5.—"Insect Enemies of Mealies in the Transvaal."
" " No. 6.—"How to secure Good Seed Maize."
" " No. 8.—"Propagation of Trees from Seed."
" " No. 9.—"Notes on Transvaal Tobacco Pests."
" " No. 10.—"How to Produce Bright Tobaccos."
" " No. 11.—"Potato Scab."
" " No. 12.—"Black Rust on the Grape."
" " No. 13.—"Budding and Grafting."
" " No. 14.—"Modern Creamery Methods."
" " No. 16.—"Meaning and Value of Analysis of Soils."
" " No. 17.—"Brands Directory," 1907.
" " No. 18.—"Judging of Butter and Cheese."
" " No. 21.—"A Butter Dairy."
" " No. 22.—"Campbell System of Dry Land Farming."
" " No. 23.—"Citrus Fruit Rot."
" " No. 24.—"Potato Rot."
" " No. 25.—"New York Apple Tree Canker."
" " No. 26.—"Inoculation of Sheep against Blue Tongue."
" " No. 29.—"A Small Cheese Dairy."
" " No. 33.—"The Adams Agricultural Act."
" " No. 34.—"The Pasteurization of Small Quantities of Milk and Cream in Bottles."
" " No. 36.—"Buttermaking."
" " No. 37.—"Sweet Milk Cheesemaking."

Miscellaneous :—

Bulletin No. 3.—"The Brands Directory, 1906."
Annual Report of the Director of Agriculture for the year 1903-04.
" " " " " 1904-05.
" " " " " 1905-06.

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JOURNAL DUPLICATES.

Any readers who possess and can spare duplicates of the *Agricultural Journal* would confer a great favour by returning them to the Department of Agriculture, as back numbers are now out of print, and applications are constantly being made by persons desirous of completing their sets.

APPLICATIONS FOR THE *JOURNAL* AND NON-DELIVERY.

Applications to be placed on the Mailing List of the *Journal*, as well as complaints as to non-delivery of the *Journal*, should be addressed to the Government Printer. P.O. Box 373, Pretoria, and not to the Editor of the *Journal*. It is particularly requested that changes of address should also be promptly notified to the Government Printer, in order to ensure prompt delivery to addressees and to avoid unnecessary correspondence.

The Transvaal Agricultural Journal is issued free to residents in the Transvaal only.

Persons residing in the other South African Colonies or Oversea may become subscribers by paying an annual subscription of 7s., post free, starting from July in each year; 2s. extra is required for postage oversea.

Subscriptions are payable strictly in advance, and should be made by bank draft, money order, bank notes, or coin. Cheques cannot be accepted in payment, unless initialled by the Bank authorities.

All correspondence must be addressed and payments made to the Government Printer, Box 373, Pretoria.

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LIST OF AGRICULTURAL SOCIETIES AFFILIATED TO THE TRANSVAAL AGRICULTURAL UNION.

Barberton	J. S. Dyce, Box 5, Barberton.
Bethal	Bergh and Croeser, Box 3, Bethal.
Carolina	Richard E. Vardy, Box 6, Carolina.
Ermelo	S. P. Bekker, Box 72, Ermelo.
Heidelberg	W. Harvey, Box 36, Heidelberg.
Klerksdorp	H. Bramley, Box 56, Klerksdorp
Lydenburg	S. Hiemstra, Box 69, Lydenburg.
Marico	S. J. van der Spuy, Box 83, Zeerust.
Middelburg	J. W. Henwood, Box 229, Middelburg.
Potchefstroom	Joubert Reitz, Box 152, Potchefstroom.
Pretoria	H. Cornforth, Box 685, Pretoria.
Standerton	J. J. Bosman, Box 26, Standerton.
Wakkerstroom	G. Maasdorp, Box 87, Volksrust.
Waterberg	J. von Backstroom, Box 7, Nylstroom.
Witwatersrand	W. H. Poultney, Box 4344, Johannesburg.
Wolmaransstad	W. D. de Greef, Box 10, Wolmaransstad.
Zoutpansberg	J. W. Johnson, Box 32, Pietersburg.

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LIST OF FARMERS ASSOCIATIONS AFFILIATED TO THE TRANSVAAL AGRICULTURAL UNION.

Aapjes River Ward	F. N. Carlisle, Pyramid Station, Pretoria.
Barberton	W. A. Gregory, Box 52, Barberton.
Crocodile River	E. G. D. Paggenpoel, P.O. Rietfontein West.
Eastern Transvaal	Secretary, Box 76, Springs.
Groot Spelonken	J. W. Walton, Private Bag, Middagzon, via Pietersburg.
Leeuwdoorns	W. H. Pilkington, Baviaans Poort, Leeuwdoorns.
Low Country	A. W. Gale, Middelrand, P.O. Devils Kloof, Zoutpansberg.
Maquassi	E. J. Brown, Maquassi Station.
New Agatha	A. W. Molyneux, Mashutiesberg, via Pietersburg.
Platrand	A. H. Barron, Platrand Station.
Piet Retief	K. P. van Dijk, Box 18, Piet Retief.
Potgietersrust	H. J. Strobel, Box 33, Potgietersrust.
Pretoria Dairy	J. W. Shackell, Box 479, Pretoria.
Pretoria Poultry Club	Matt. Lochhead, Box 1129, Pretoria.
Southern Waterberg	J. A. Manson, Illawarra, P.O. Settlers.
Transvaal	E. W. Hunt, Box 3785, Johannesburg.
Transvaal Settlers	Secretary, Kroomdraai Station.
Transvaal Stock Breeders	F. T. Nicholson, Box 134, Pretoria.
Transvaal Land Owners	H. A. Baily, Box 1281, Johannesburg.
Transvaal Con. Land Co	C. A. Madge, Box 4303, Johannesburg.
Trichardts	E. van Deventer, P.O. Trichardts, via Bethal.
Witwatersrand	H. J. A. Wentworth, P.O. Craighall, near Johannesburg.
Witwatersrand Dairy	Alex. Sloan, Box 5908, Johannesburg.
White River	Edmond M. Dwyer, P.O. White River, via Nelspruit.
Wolmaransstad	Secretary, Wolmaransstad.

OTHER SOCIETIES.

Belfast Agricultural Society...	I. F. Vermooten, Box 18, Belfast.
South African Bee Keepers' Association	Hon. Secretary and Treasurer, George S. Oettlé; Senior Bee Expert, F. Sworder.

OTHER COLONIES.

Agricultural Union of Cape Colony, D. M. Brown, Box 187, Port Elizabeth.
Bloemfontein and O.R.C. Agricultural Society, J. Fraser, Box 250, Bloemfontein.
Cape Central Farmers' Association, H. C. Hall, Bedford, Cape Colony.
Cape Stud Breeders' Association, J. Pike, Box 703, Capetown.
Natal Agricultural Union, D. M. Eadie, Timber Street, Pietermaritzburg.
Orange River Colony Central Farmers' Association, W. B. Fowler, Secretary, Hill's Buildings, Maitland Street, Bloemfontein.
Orange River Colony Stockbreeders' Association, Secretary, Bloemfontein.
Rhodesian Agricultural Union, Secretary, Box 135, Salisbury, Rhodesia.
South African Co-operative Union, A. C. Lyell, Box 574, Bloemfontein, O.R.C.
Upper Klip River Farmers' Association, Secretary, Vrede District, O.R.C.

In view of the fact that several errors have been detected in the List of Farmers Associations and Agricultural Societies in the Transvaal, we propose to publish a revised list, and shall be glad if all secretaries of associations and societies which have been omitted will kindly communicate with the Editor.

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LIST OF OFFICIALS.

The following is a list of the officials of the Transvaal Department of Agriculture, to whom enquiries respecting matters connected with agriculture may be addressed:—

The Right Hon. the Minister of Agriculture..................	General Louis Botha.
Acting Director of Agriculture	C. E. Gray.
Government Veterinary Bacteriologist...	Dr. A. Theiler.
Principal Veterinary Surgeon...........	C. E. Gray.
Acting Chief Chemist....................	R. D. Watt.
Agrostologist and Botanist.......	J. Burtt-Davy.
Plant Pathologist........................	I. B. Pole Evans.
Conservator of Forests.....................	C. E. Legat.
Acting Entomologist..	D. G. Gunn.
Horticulturist...	R. A. Davis.
Chief of Tobacco Division..................................	J. van Leenhoff.
Superintendent of Co-operation..............	B. Stilling-Andersen.
Superintendent of Dairying.................................	Robert Pape.
Agricultural Statistician...................................	G. F. Joubert.
Editor, *Agricultural Journal*, and Dry-Land Agronomist.........	William Macdonald.
Poultry Expert, Government Experimental Farm, Potchefstroom	R. Bourlay.
General Manager, Government Experimental Farm, Potchefstroom	Alexander Holm.
General Manager, Government Stud Farm, Standerton..........	A. McNae.
General Manager, Government Stud Sheep Farm, Ermelo.......	V. Bossley.
Acting Manager, Government Experimental Farm, Tzaneen......	Walter H. Charter.
Registrar of Brands and Controller of Fencing..	J. J. Pienaar.
Chief Clerk..	B. Enslin.
Accountant..	A. J. Firth.
Translator...	Otto Menzel.
Librarian..	J. C. Goldman.

* * * *

ADDRESS.

Correspondents are earnestly requested to give their full name and correct postal address when forwarding any communication to the Department. It sometimes happens that readers send their farm address only, and fail to give the Post Office address, consequently it is impossible to reply to their queries or send publications. This refers more especially to farmers applying for cattle permits, as in many cases letters forwarded by the Veterinary Division are returned by the Postal Authorities to the effect "Not delivered. Address insufficient." The Department should also be immediately notified of any change of address.

SOUTH AFRICAN STUD BOOK.

A record of all classes of stock, the object being to encourage the breeding of thoroughbred stock and to maintain the purity of breeds, thus enhancing their value to the individual owner and to the country generally.

Application for membership and entries of stock should be addressed to—

For Cape Colony—A. A. Persse, P.O. Box 703, Capetown.
For Transvaal—F. T. Nicholson, P.O. Box 134, Pretoria.
For Orange River Colony—E. J. MacMillan, Government Buildings, Bloemfontein.

The South African Stud Book, Volume I, is obtainable from T. Maskew Miller, Adderley Street, Capetown. Price, 10s. 6d.

A. A. PERSSE, *Secretary*,
South African Stud Book Association.

* * * *

CONDITIONS OF BONDS AT THE TRANSVAAL LAND AND AGRICULTURAL BANK.

1. That the mortgagor will pay the principal sum mentioned in the mortgage with interest thereon in accordance with the provisions of the Land and Agricultural Bank Act, 1907, as amended by the Land and Agricultural Bank Amendment Act, 1908, and at the due dates thereof.

2. That the mortgagor will from time to time so long as money remains owing on this security, well and substantially repair and keep in good and substantial repair and condition all buildings or other improvements erected and made upon the said land, and the Bank may at all times be at liberty by itself, its agents, or servants to enter upon the said land to view and inspect the said buildings and improvements.

3. That if the mortgagor fails or neglects to repair the said buildings and improvements or to keep them in good and substantial repair and condition as aforesaid, then and in any such case and as often as the same shall happen it shall be lawful for but not obligatory upon the Bank, at the cost and expense in all things of the mortgagor, to repair the said buildings and improvements and keep them in good and substantial repair and condition.

4. That all moneys expended by the Bank in and about in repairing or keeping in repair any of the said buildings and improvements as aforesaid or in attempting to exercise or enforce any power, right, or remedy herein contained or implied in favour of the Bank shall be payable to the Bank by the mortgagor on demand, and until paid shall be charged on the said land, together with the interest thereon at the rate of not more than six per centum per annum computed from the date or dates of such moneys being expended.

5. Insurance shall be effected as may be prescribed by regulation or instruction of the Board. Every policy of insurance so effected shall be ceded to the Bank as collateral security.

6. That the power of sale and incidental powers in that behalf conferred upon the Bank under section *thirty-three* of the Land and Agricultural Bank Act, 1907, amended as aforesaid, shall be implied herein and that they may be exercised without any notice or demand whatsoever if and whenever the mortgagor makes default for three months in the full and punctual payment of any instalment of interest or principal in accordance with the respective covenants for the payment thereof herein contained or if and whenever the mortgagor makes default in the faithful observance and performance of any other covenant or condition on his part herein contained or implied.

7. That if and whenever the mortgagor makes any such default as in the last preceding covenant mentioned it shall be lawful for the Bank to call up and compel payment of all principal, interest, and other moneys for the time being owing under this security, notwithstanding that the time or times hereinbefore appointed for the payment thereof respectively may not have arrived.

8. That the mortgagor will at all times cultivate and manage the mortgaged land in a skilful and proper manner and according to the rules of good husbandry. Failure in the performance of this condition shall entail the immediate recovery of the loan should the Bank so desire. This section shall, however, not apply to a farm mortgaged as security and used exclusively for stock farming.

9. That this mortgage is subject to all the provisions of the Land and Agricultural Bank Act, 1907, amended as aforesaid, relating to mortgages under those Acts.

TRANSVAAL LAND AND AGRICULTURAL BANK, PRETORIA.

Table of Prescribed Half-Yearly Instalments

Payable in Advance for every £100 (One Hundred Pounds) of the Loan, at Seven Pounds per centum, namely, Five Pounds per centum for interest, and the balance in reduction of the capital, such half-yearly payments beginning at first half-year.

Half-Year.	Prescribed Half-Yearly Instalments.			Apportioned thus: On Account of Interest at 5 per cent.			Apportioned thus: On Account of Principal.			Balance of Principal.		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
1st	3	10	0	2	10	0	1	0	0	99	0	0
2nd	3	10	0	2	9	8	1	0	4	97	19	8
3rd	3	10	0	2	9	0	1	1	0	96	18	8
4th	3	10	0	2	8	4	1	1	8	95	17	0
5th	3	10	0	2	8	0	1	2	0	94	15	0
6th	3	10	0	2	7	4	1	2	8	93	12	4
7th	3	10	0	2	6	8	1	3	4	92	9	0
8th	3	10	0	2	6	4	1	3	8	91	5	4
9th	3	10	0	2	5	8	1	4	4	90	1	0
10th	3	10	0	2	5	0	1	5	0	88	16	0
11th	3	10	0	2	4	4	1	5	8	87	10	4
12th	3	10	0	2	3	8	1	6	4	86	4	0
13th	3	10	0	2	3	0	1	7	0	84	17	0
14th	3	10	0	2	2	8	1	7	4	83	9	8
15th	3	10	0	2	1	8	1	8	4	82	1	4
16th	3	10	0	2	1	0	1	9	0	80	12	4
17th	3	10	0	2	0	4	1	9	8	79	2	8
18th	3	10	0	1	19	8	1	10	4	77	12	4
19th	3	10	0	1	18	8	1	11	4	76	1	0
20th	3	10	0	1	18	0	1	12	0	74	9	0
21st	3	10	0	1	17	4	1	12	8	72	16	4
22nd	3	10	0	1	16	4	1	13	8	71	2	8
23rd	3	10	0	1	15	8	1	14	4	69	8	4
24th	3	10	0	1	14	8	1	15	4	67	13	0
25th	3	10	0	1	14	0	1	16	0	65	17	0
26th	3	10	0	1	13	0	1	17	0	64	0	0
27th	3	10	0	1	12	0	1	18	0	62	2	0
28th	3	10	0	1	11	0	1	19	0	60	3	0
29th	3	10	0	1	10	0	2	0	0	58	3	0
30th	3	10	0	1	9	0	2	1	0	56	2	0
31st	3	10	0	1	8	0	2	2	0	54	0	0
32nd	3	10	0	1	7	0	2	3	0	51	17	0
33rd	3	10	0	1	6	0	2	4	0	49	13	0
34th	3	10	0	1	5	0	2	5	0	47	8	0
35th	3	10	0	1	3	8	2	6	4	45	1	8
36th	3	10	0	1	2	8	2	7	4	42	14	4
37th	3	10	0	1	1	4	2	8	8	40	5	8
38th	3	10	0	1	0	0	2	10	0	37	15	8
39th	3	10	0	0	19	0	2	11	0	35	4	8
40th	3	10	0	0	17	8	2	12	4	32	12	4
41st	3	10	0	0	16	4	2	13	8	29	18	8
42nd	3	10	0	0	15	0	2	15	0	27	3	8
43rd	3	10	0	0	13	8	2	16	4	24	7	4
44th	3	10	0	0	12	0	2	18	0	21	9	4
45th	3	10	0	0	10	8	2	19	4	18	10	0
46th	3	10	0	0	9	4	3	0	8	15	9	4
47th	3	10	0	0	7	8	3	2	4	12	7	0
48th	3	10	0	0	6	0	3	4	0	9	3	0
49th	3	10	0	0	4	8	3	5	4	5	17	8
50th	6	0	8	0	3	0	5	17	8		—	

ORANGE CODLING MOTH.

It is hereby notified for general information that the Government of the Province of Mozambique has decided to condemn consignments of citrus fruits infested with the orange codling moth (Enarmonia batracopba) which are imported into that territory.

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GOVERNMENT NOTICE NO. 770 OF 1908.

WARNING.—POTATO ROT.

Importers of seed-potatoes are hereby warned that in view of the fact that large quantities of seed-potatoes from France and Germany consigned to this Colony last season were found affected with the white rot fungus (Nectria solani, Pers.), it is the intention of the Government to safeguard the interests of local growers by ordering the destruction, or return to the consignor, of all potatoes found infected with this fungus to the extent of one per cent. and upwards.

F. B. SMITH,
Director of Agriculture.

Department of Agriculture,
Pretoria, 11th August. 1908.

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GOVERNMENT NOTICE NO. 847 OF 1908.

WARNING.—CITRUS FRUIT ROT.

Importers of fruit are hereby warned that in view of the fact that large consignments of citrus fruits affected with the citrus fruit rot fungus [Penicillium digitatum (Fr.) Sacc.] are arriving in this Colony, it is the intention of the Government to safeguard the interests of local fruit-growers and shippers by ordering the destruction, or return to the consignor, of all citrus fruits found infected with this fungus to the extent of one per centum and upwards.

C. E. GRAY,
Acting Director of Agricultuure.

Department of Agriculture,
Pretoria, 26th August, 1908.

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GOVERNMENT NOTICE NO. 957 OF 1908.

IMMUNIZATION OF MULES.

It is hereby notified for general information that the Government Veterinary Surgeons are now prepared to undertake the immunization of mules against horse-sickness, in the districts in which veterinary surgeons are stationed, at the undermentioned reduced rates and subject to the following conditions:—

(a) *With Insurance:* On payment of a fee of £1 per head for each mule immunized, the Government undertakes to pay in compensation for any animal dying as a result of inoculation whilst under treatment, according to a valuation fixed by the Government Veterinary Surgeon, an amount not exceeding £15 per animal; provided the Government Veterinary Surgeon certifies that the conditions imposed by him have been duly complied with.

(b) *Without Insurance:* On payment of a fee of 10s. per animal, provided the owner signs a declaration to the effect that he understands clearly that, by availing himself of the reduced fee for inoculation, he forfeits any right which he may have to compensation in the event of any mule dying after inoculation, and that the Government gives no guarantee regarding the immunity of the animals inoculated.

Any animal intended for inoculation may, at the discretion of the Government Veterinary Surgeon, be tested with mallein before being inoculated against horse-sickness.

Any owner of mules desirous of having them inoculated is requested to make early application to the Government Veterinary Surgeon of his district.

Government Notice No. 1014 of 1905 shall be and is hereby withdrawn.

C. E. GRAY,
Acting Director of Agriculture.

Department of Agriculture,
Pretoria, 22nd September, 1908.

GOVERNMENT NOTICE No. 583 OF 1908.

PROHIBITION OF IMPORTATION OF CATTLE FROM NATAL.

It is hereby notified for general information that His Excellency the Governor has been pleased, under and by virtue of the powers in him vested by section *five* of the Stock Diseases Ordinance, 1902, to cancel the regulations published under Government Notice No. 1150 of 1907, and to substitute the following therefor:—

(1) No person shall import any cattle into this Colony from the Colony of Natal, and any person contravening this regulation shall be liable, on conviction, to a fine not exceeding fifty pounds, and in default of payment to imprisonment with or without hard labour for a period not exceeding six months.

(2) Any cattle which may, after the date of the promulgation of these regulations, come into this Colony from the Colony of Natal may be seized by any resident magistrate, native commissioner, field cornet, sub-commissioner of natives, justice of the peace, police officer, or constable, and detained and taken to a place of isolation, and the person so seizing and detaining such cattle shall immediately report all the circumstances to the Minister of Agriculture who may order any such cattle to be slaughtered or otherwise dealt with.

F. B. SMITH,
Director of Agriculture.

Department of Agriculture,
Pretoria, 24th June, 1908.

* * * *

GOVERNMENT NOTICE No. 1140 OF 1908.

PROHIBITION OF IMPORTATION OF CATTLE FROM THE BECHUANALAND PROTECTORATE.

It is hereby notified for general information that His Excellency the Governor has been pleased, under and by virtue of the powers in him vested by section *five* of the Stock Diseases Ordinance, 1902, to cancel Government Notice No. 613 of 1907, and to frame the following regulations:—

(1) No person shall import any cattle into this Colony from the Bechuanaland Protectorate, and any person contravening this regulation shall be liable, on conviction, to imprisonment with or without hard labour, without the option of a fine, for a period not exceeding six months.

(2) Any cattle which may, after the date of the promulgation of these regulations, come into this Colony from the Bechuanaland Protectorate may be seized by any resident magistrate, native commissioner, field cornet, sub-commissioner of natives, justice of the peace, police officer, or constable, and detained and taken to a place of isolation, and the person so seizing and detaining such cattle shall immediately report all the circumstances to the Minister of Agriculture who may order any such cattle to be slaughtered or otherwise dealt with.

C. E. GRAY,
Acting Director of Agriculture.

Department of Agriculture,
Pretoria, 12th November, 1908.

* * * *

GOVERNMENT NOTICE No. 877 OF 1908.

STOCK DISEASE REGULATIONS.—TUBERCULOUS CATTLE.

It is hereby notified for general information that, under the powers of section *five* of Ordinance No. 17 of 1902, which Ordinance has, by Proclamation No. 1 Admn. 1907, been applied to the disease of tuberculosis, His Excellency the Governor has been pleased to approve of the following regulations:—

(1) No person shall import from the following districts of Cape Colony, viz., Cape, Caledon, Malmesbury, Paarl, and Stellenbosch, any breeding cattle unless such cattle are accompanied by the usual import permit required by the regulations of the Department of Agriculture.

(2) No person shall import from the said districts of Cape Colony any cattle which are not accompanied by a certificate in the form set forth in Annexure A hereto issued and signed by a Government Veterinary Surgeon or such other duly qualified veterinary surgeon as may be specially appointed by the Secretary

for Agriculture, Capetown, for the purpose, to the effect that such cattle have been submitted to the tuberculin test and have given no indication of the presence of tuberculosis; provided that in case of certificates issued by authorised veterinary surgeons in private practice such certificates shall be accepted subject to counter-signature by the Chief Veterinary Surgeon. Such certificate shall only be valid provided it indicates that the animal or animals referred to therein have been tested with tuberculin within six weeks before the date of their introduction into this Colony.

(3) Any person contravening these regulations shall, on conviction, be liable to a fine not exceeding fifty pounds, or in default of payment to imprisonment with or without hard labour for a period not exceeding six months.

(4) Any cattle which may, after the taking effect of these regulations, have come into this Colony from the said districts of the Cape Colony may be seized by any magistrate, veterinary surgeon, stock inspector, native commissioner, native sub-commissioner, justice of the peace, field cornet, police officer, or constable, and detained and taken to a place of isolation, and any person so seizing and detaining such cattle shall immediately report all the circumstances in connection with such seizure to the Minister of Agriculture who may order such cattle to be slaughtered forthwith or to be otherwise dealt with.

C. E. GRAY,
Acting Director of Agriculture.

Department of Agriculture,
Pretoria, 2nd September, 1908.

ANNEXURE A.

I do hereby certify that the undermentioned cattle are free from infectious or contagious disease, and have been subjected by me to the test known as the tuberculin test, and have given no indication of the presence of tuberculosis.

Number and general description of cattle ....
Date when tested...
Place from which sent...
Owner's name and address...
Name of person in charge ....
Place in the Transvaal to which cattle are being sent ....

....
Signature of Veterinary Surgeon.

Countersigned:

....
Chief Veterinary Surgeon.

* * * *

LIST OF ADDRESSES OF FIELD CORNETS.

PIET RETIEF.

Piet Retief	Jan Christoffel Greyling Kemp, P.O. Box 10, Piet Retief.
Assegaai River	Heinrich Martin Friedrich Meyer, P.O. Wittenberg.

WAKKERSTROOM.

Wakkerstroom	Gerhardus Johannes Janse van Rensburg, Poortje, P.O. Vaalbank, Wakkerstroom.
Amersfoort	Gabriel Michael Carel Swart, Vaalbank, Amersfoort.
Volksrust	Christian Burger Pringle, P.O. Volksrust.

STANDERTON.

Blesbokspruit	Hendrik Johannes Janse van Vuren, Rietvlei, P.O. Blesbokspruit.
Waterval	Johannes Joachim Alberts, Klipdrift, P.O. Val Station.
Klip River	Coenraad Jacobus Brits, Leeuwkraal, P.O. Platrand Stn.
Steenkoolspruit	Adam Gilfillan, Dorstfontein, P.O. Onverwacht, Bethal.
Bethal	Petrus Johannes Dirk Erasmus, Groenpunt, P.O. Box 63, Bethal.

ERMELO.

Ermelo	Abraham Gerhardus Kleynhans, Vlakplaats, P.O. Brakfontein.
Amsterdam	Johannes Nicholaas Hermanus Grobler, P.O. Bankkop.
Lake Chrissie	Barend Jacobus Johannes Smit, P.O. Box 56, Ermelo.

CAROLINA.

Carolina	Johannes Hieronimus Brink, P.O. Box 37, Carolina.
Theespruit	Willem Hendrik de Villiers, P.O. Carolina.
Komati River	Johannes Lodewikus Grobler, Drenthe, P.O. Bonnefoi Stn.

BARBERTON.

Barberton	Hendrik Thomas Watkins, P.O. Barberton.
White River	Paul Michael Marits, Kaapsche Hoop.

LYDENBURG.

Steelpoort	Jacobus Nieuwenhuize, Rietfontein, P.O. Boschfontein.
Ohrigstad	Pieter Barend Swart, Uitkomst, P.O. Rustplaats.
Krokodil	David Johannes Schoeman, Rietfontein School, P.O. Rietfontein.
Steenkampsberg	Christiaan Cornelius Cloete Joubert, P.O. Dullstroom.

MIDDELBURG.

Olifants River	Gerhardus Wilhelmus van Niekerk, Goedehoop, P.O. Vaalkrants.
Steenkoolspruit	Joachim Johannes Cornelis van Niekerk, Doornrug, P.O. Balmoral.
Mapochsgronden	Adam Johannes Willemse, P.O. Tonteldoos.
Selons River	Josias Servaas de Kock, P.O. Box 3, Middelburg.
Secocoeniland	Christian Ernst Schutte, Rietfontein, P.O. Pokwani.

ZOUTPANSBERG.

Mara (North)	Marthinus Johannes Petrus Biermann, Bergplaats, P.O Mara.
Rhenosterpoort	Andries Stephanus David Erasmus, Smitsplaats, P.O. Pietersburg.
Marabastad	Christoffel Hofmeyr, P.O. Marabastad.
Olifants	Ernst Lodewikus Marais, De Diepte, P.O. Chunespoort.
Groot Spelonken	Johannes Frederik Lodewikus Janse van Rensburg Rustfontein, P.O. Buffels.
Klein Spelonken	Pieter Willem Möller, Groblerplaats, P.O. Louis Trichardt.
Woodbush	Austin Welsh Wienand, Laatstehoop, P.O. Smitsdrift.
Low Country, Klein Letaba ..	Jacobus Cornelis Boltman, Korthanie, P.O. Duivelskloof.

PRETORIA.

Crocodile River	Marthinus Nicholaas Riekert, Hartebeestpoort, P.O. Rietfontein West.
Witwatersrand	John Geo. Jones, P.O. Hennops River.
Bronkhorstspruit	Jacobus van der Walt, Knoppiesfontein, P.O. Bapsfontein, Kaalfontein Station.
Elands River	Pieter Lafras Uys, Rietfontein, Bronkhorstspruit Station.
Aapies River	Johannis Barend Wolmarans, Donkerhoek, P.O. Hatherley.

RUSTENBURG.

Hex River	Georg Heinrich Wilhelm Behrens, P.O. Bethanie.
Elands River	Roelof Jacobus Petrus van Tonder, Rietfontein, P.O. Brakkloof, Marico Station.
Highveld	Pieter Stephanus Steenekamp, P.O. Cyferbult.
Zwart Ruggens	Petrus Jacobus van der Walt, Witrand, P.O. Koster.

HEIDELBERG.

Roodekoppen	Andries Jacobus Greyling, Roodewal, P.O. Greylingstad Station.
Highveld	Willem Francois Pretorius, Rietfontein, P.O. Devon Station, via Springs.
Suikerboschrand	Johannes Stephanus Fourie, Boschfontein, P.O. Heidelberg.
Klip River	William George Devenish, Witkoppies, Meyerton.

KRUGERSDORP.

Krugersdorp	Nicholaas Jacobus Pretorius, jun., Hartebeesthoek, P.O. Scheerpoort, Pretoria.
Witwatersberg	Frederik Jacobus Potgieter, Nooitgedacht, P.O. Hekpoort.
West Rand	Christoffel Frederik Theodorus Hendrikz, Luipaardsvlei, P.O. Randfontein.

POTCHEFSTROOM.

Upper Mooi River	Stephanus Gottfried Kriegler, P.O. Frederikstad.
Gats Rand	Jacobus Francois van der Merwe, Leeuwkop, P.O. Kraalkop.
Vaal River	Nicholaas Marthinus Prinsloo, Modderfontein, P.O. Lindeques Drift.
Upper Schoonspruit	Daniel Johannes Ysel, Elandskuil, P.O. Ventersdorp.
Lower Schoonspruit	Pieter Jacobus Jooste, P.O. Box 5, Hartebeestfontein.

MARICO.

Bushveld	Francois Johannes Diederik Furstenburg, Witpoortje, Zeerust.
Klein Marico	Daniel Lourens Botha, Weltevreden, P.O. Box 97, Zeerust.
Groot Marico	Lourens van Niekerk, Doornkraal, P.O. Wonderfontein.
Highveld	Willem Adriaan Lombaard, Rietspruit, P.O. Grootafdeeling.
Moloppo	Charles Pieter Marais, P.O. Ottoshoop.

LICHTENBURG.

Zoutpan	Andries Petrus Visser, Leeuwpan, P.O. Barberspan.
Lower Harts River	Hendrik Cornelis Wilhelmus Vermaas, jun., Post Bag, Doornpoort, P.O. Hartebeestfontein
Upper Harts River	Gabriel Johannes Greeff, P.O. Manana.

BLOEMHOF.

Schweizer Reneke	Louis Elwin Lauritz, Mussmann, P.O. Schweizer Reneke.
Christiana	Paul Johannes Maré, Grootplaats, P.O. Christiana.
Bloemhof	Pieter de la Rey Swartz, Bierfontein, P.O. Bloemhof.

WOLMARANSSTAD.

Upper Ward	Wouter Cornelis Justinus Brink, Vlakfontein, P.O. Witfontein.
Lower Ward	Sarel Petrus du Toit, Wildebeestkantoor, P.O. Leeuwdoorns.

WATERBERG.

Koedoesrand and Zoutpan ..	Marthinus Phillippus van Staden, Hoornbosch, P.O. Oranjefontein.
Zwagershoek	Christoffel Bernardus Swanepoel, Knopfontein, P.O. Alma.
Nylstroom	Hermanus Stephanus Lombard, Grootvlei, P.O. Box 21, Nylstroom.
Potgieters	Daniel Petrus van Rooyen, P.O. Potgietersrust.

Transvaal Meteorological Department.

OBSERVATIONS OF TEMPERATURES (FROM SELF-REGISTERING THERMOMETERS IN STEVENSON-TYPE SCREENS).—AUGUST, 1908.

PLACE.	FOR THE MONTH. Mean Max.	Mean Min.	Mean.	HIGHEST.	LOWEST.
	degs.	degs.	degs.	degs.	degs.
Bloemhof	70·9	40·7	55·8	84·0 on 29th	29·0 on 4th and 5th
Johannesburg—					
Joubert Park ...	66·2	42·9	54·6	76·0 „ 28th and 31st	32·5 on 3rd
Observatory ...	66·0	44·9	55·1	76·8 „ 31st	31·3 „ 3rd
Komatipoort	85·1	53·2	69·2	97·5 „ 21st	40·0 „ 4th
Pietersburg	74·8	43·6	59·2	88·0 „ 31st	34·0 „ 5th
Pretoria, Arcadia ...	74·9	40·7	57·8	85·2 „ 31st	28·0 „ 4th
Standerton	69·4	30·4	49·9	80·0 „ 30th	20·0 „ 18th
Zeerust	75·9	40·9	58·4	87·5 „ 31st	28·9 „ 4th

The mean temperature of the month is on the average one and a half degrees higher than that of August, 1907. Moderately low temperatures were experienced in the earlier part of the month, but the latter part was unusually mild, with a prevalence of dry winds

RAINFALL RETURN FOR AUGUST, 1908.

(Including Rainfall since 1st July last and the corresponding figures for previous season.)

NOTE. The rainy season is measured from 1st July in one year to the 30th June in the next.

DISTRICT.	PLACE.	MONTH. Aug., 1908. Ins.	Days.	SEASON. From 1st July, 1908. Ins.	Days.	AVERAGES. Month. Ins.	Days.	Season. Ins.	Days.
Barberton ...	Barberton	0·19	3	0·24	6	0·13	1	0·14	1
	Komatipoort	0·68	2	0·69	3	0·21	1	0·27	1
Bethal ...	Bethal	0·51	3	1·00	6	0·15	1	0·25	2
Bloemhof ...	Bloemhof	0·93	3	2·35	8	0·19	1	0·48	2
Carolina ...	Carolina	0·25	3	0·30	4	0·06	1	0·07	1
Ermelo ...	Ermelo	1·16	3	1·40	6	0·25	1	0·31	2
Heidelberg ...	Vereeniging	0·48	4	1·02	11	0·20	1	0·29	3
	Heidelberg	0·15	3	0·68	8	0·09	1	0·20	2
Lydenburg ...	Belfast	0·09	3	0·09	3	0·11	2	0·12	3
	Pilgrims Rest	0·35	4	1·02	9	0·11	2	0·38	4
Marico ...	Zeerust	-	0	1·17	4	0·06	1	0·29	2
Middelburg ...	Middelburg	0·26	3	0·33	4	0·07	1	0·08	1
Piet Retief	Piet Retief	1·08	4	1·31	7	0·29	2	0·39	4
Potchefstroom	Klerksdorp	0·90	2	1·76	6	0·23	1	0·40	2
	Potchefstroom	0·65	3	1·34	7	0·16	1	0·30	2
Pretoria ...	Arcadia, Pretoria ...	0·03	2	0·48	4	0·04	1	0·22	2
	Govt. Buildings, Pretoria		0	0·34	2	0·03	1	0·08	1
	Modderfontein	0·10	2	0·66	5	0·03	1	0·13	2
Rustenburg ...	Rustenburg	-	0	1·25	3	—	—	—	—
Standerton ...	Standerton	1·23	5	1·67	9	0·39	1	0·48	2
Swaziland ...	Mbabane	1·40	9	2·76	16	0·62	4	1·03	7
Wakkerstroom	Volksrust	1·41	5	1·65	10	0·37	2	0·46	3
	Wakkerstroom	1·57	4	1·57	4	0·51	1	0·54	2
Waterberg ...	Nylstroom	--	0	0·07	2	0·05	1	0·07	1
	Potgietersrust	-	0	0·27	2	0·10	1	0·15	1
Witwatersrand	Krugersdorp	0·10	1	0·80	4	0·04	1	0·15	1
	Joubert Park, J'burg ...	0·23	3	1·26	8	0·06	1	0·23	2
	Govt. Observatory, J'burg	0·16	3	1·00	6	0·04	1	0·22	2
Wolmaransstad	Wolmaransstad	0·57	3	1·48	7	0·11	1	0·29	1
Zoutpansberg	Pietersburg	--	0	0·39	3	0·13	1	0·20	1
	Leydsdorp	—	0	0·04	1	--	—	—	—

SUMMARY.—The rainfall of the month has been very good over the east, south-east, and south-west of the Transvaal, was slightly above the average over the centre of the Colony, but deficient over the north and west.

Observations of Temperatures (from Self-registering Thermometers in Stevenson-type Screens).—September, 1908.

Place.	For the Month. Mean Max.	Mean Min.	Mean.	Highest.	Lowest.
	degs.	degs.	degs.	degs.	degs.
Bloemhof	79·6	50·1	64·8	89·0 on 19th	36·0 on 22nd
Johannesburg—					
Joubert Park ...	73·9	50·6	62·2	82·0 „ 28th	44·0 „ 21st
Observatory ..	71·9	51·8	61·8	81·2 „ 28th	42·9 „ 13th
Komatipoort	92·1	60·4	76·2	107·0 „ 29th	50·0 „ 4th
Nylstroom	84·0	49·3	66·6	94·2 „ 21st	41·2 „ 4th
Pretoria, Arcadia ...	82·6	49·6	66·1	93·3 „ 28th	44·0 „ 5th
Volksrust	73·0	44·6	58·8	83·0 „ 20th	39·0 „ 17th
Zeerust	83·2	50·8	67·0	92·2 „ 28th	41·4 „ 11th

September, 1908, has been a very mild month. Compared with September, 1907, mean temperatures have been generally about three degrees higher, and minimum readings have been about five degrees higher.

Rainfall Return for September, 1908.

(Including Rainfall since 1st July last and the corresponding figures for previous season.)

Note.—The rainy season is measured from 1st July in one year to the 30th June in the next.

District.	Place.	Month. Sept., 1908. Ins.	Days.	Season. From 1st July, 1908. Ins.	Days.	Averages. Month. Ins.	Days.	Averages. Season. Ins.	Days.
Barberton ...	Barberton	2·60	5	2·81	11	0·75	2	0·89	4
	Komatipoort	0·49	3	1·18	6	0·72	1	1·00	3
Bethal ...	Bethal	0·78	5	1·78	11	0·72	3	0·98	5
Bloemhof ...	Bloemhof	1·44	5	3·79	13	1·26	3	1·74	5
Carolina ...	Carolina	0·91	4	1·21	8	0·86	3	0·93	4
Ermelo ...	Ermelo	1·34	5	2·74	11	0·78	5	1·09	7
Heidelberg ...	Heidelberg	0·81	5	1·49	13	1·09	4	1·29	6
	Vereeniging	1·35	3	2·37	14	0·78	3	1·07	6
Lydenburg ...	Belfast	1·31	6	1·40	9	1·32	4	1·41	7
	Pilgrims Rest	0·69	6	1·71	15	0·65	5	1·03	11
Marico ...	Zeerust	0·82	3	1·99	7	0·66	2	0·95	3
Middelburg ...	Middelburg	0·73	4	1·06	8	0·74	2	0·82	4
Piet Retief ...	Piet Retief	2·32	6	3·63	13	1·18	--	1·54	—
Potchefstroom	Potchefstroom	1·68	4	3·02	11	1·16	3	1·47	6
	Klerksdorp	1·43	4	3·19	10	0·84	3	1·25	5
Pretoria ...	Arcadia, Pretoria ...	0·33	3	0·81	7	0·45	2	0·57	3
	Govt. Buildings, Pretoria	0·29	3	0·63	5	0·42	2	0·51	3
Rustenburg ...	Rustenburg	0·62	4	1·87	7	—	—	—	—
Standerton ...	Standerton	0·64	5	2·31	14	1·03	3	1·51	6
Swaziland ...	Mbabane	2·67	11	5·43	27	1·53	6	2·65	14
Wakkerstroom	Volksrust	1·02	4	2·67	14	0·85	4	1·31	7
	Wakkerstroom	1·40	5	2·97	9	0·99	5	1·53	7
Waterberg ...	Nylstroom	0·47	2	0·54	4	0·96	1	1·03	2
	Potgietersrust	0·05	2	0·32	4	0·55	1	0·70	2
Witwatersrand	Joubert Park, J'burg ...	0·80	6	2·06	14	0·90	3	1·13	5
	Govt. Observatory, J'burg	0·84	5	1·84	11	0·94	3	1·16	5
Zoutpansberg	Pietersburg	0·16	1	0·55	4	0·46	7	0·67	2
	Leydsdorp	1·16	2	0·20	3	—	—	—	—

Summary.—The rainfall for the month has been above the average over the west, south-west, south-east, and east districts, about the average over the centre of the Colony, and deficient in the north.

For the first quarter (July-September) of the season, the total rainfall is decidedly above the average of the corresponding quarter of the last four years, except in the northern districts of the Transvaal.

Observations of Temperatures (from Self-registering Thermometers in Stevenson-type Screens).—October, 1908.

Place.	For the Month. Mean Max.	Mean Min.	Mean.	Highest.	Lowest.
	degs.	degs.	degs.	degs.	degs.
Barberton	79·6	59·7	69·6	95·3 on 16th	47·8 on 6th
Bloemhof	81·1	49·8	65·4	95·0 „ 16th & 17th	32·0 „ 6th
Johannesburg—					
Marist Bros. School	75·1	51·4	63·2	90·0 „ 18th	35·0 „ 5th & 7th
Observatory ...	72·6	50·3	61·4	84·1 „ 17th	33·1 „ 6th
Pietersburg	82·5	55·5	69·0	94·0 „ 19th	41·0 „ 6th
Pretoria, Arcadia ...	82·8	52·7	67·8	95·5 „ 18th	39·0 „ 7th
Volksrust	73·9	46·6	60·2	87·0 „ 18th & 19th	33·2 „ 4th
Zeerust	83·8	53·4	68·6	98·1 „ 17th & 18th	38·9 „ 8th

The mean temperature of October, 1908, is practically the same as that of October, 1907, but the variations of temperature have been rather larger, the maxima being higher and the minima lower.

Rainfall Return for October, 1908.

(Including Rainfall since 1st July last and the corresponding figures for previous season.)

Note.—The rainy season is measured from 1st July in one year to the 30th June in the next.

District.	Place.	Month: Oct., 1908. Ins.	Days.	Season: From 1st July, 1908. Ins.	Days.	Averages: Month. Ins.	Days.	Season. Ins.	Days.
Barberton ...	Barberton	2·40	16	5·21	27	1·99	9	2·89	11
	Komatipoort	0·98	3	2·16	9	2·33	7	3·45	11
Bethal ...	Bethal	3·92	8	5·70	19	3·14	8	4·12	13
Bloemhof ...	Bloemhof	0·38	4	4·17	17	0·83	5	2·57	10
Carolina ...	Carolina	2·27	9	3·48	17	2·96	6	3·90	10
Ermelo ...	Ermelo	4·31	8	7·05	19	3·56	9	4·66	16
Heidelberg ...	Vereeniging	2·34	8	4·71	22	1·76	7	2·84	14
	Heidelberg	2·26	7	3·75	20	1·92	7	3·22	14
Lydenburg ...	Pilgrims Rest	2·27	12	3·98	27	2·48	11	3·51	22
Marico ...	Zeerust	2·49	8	4·48	15	1·65	7	2·60	10
Middelburg ...	Middelburg	2·12	6	3·18	14	2·46	8	3·29	12
Piet Retief ...	Piet Retief	5·96	14	9·59	27	4·33	–	5·90	–
Potchefstroom	Klerksdorp	2·66	6	5·85	16	1·42	7	2·66	13
	Potchefstroom	1·73	6	4·75	17	1·40	6	2·89	12
Pretoria ...	Arcadia, Pretoria ...	4·08	7	4·89	14	2·34	7	2·91	10
	Govt. Buildings, Pretoria	2·81	7	3·14	12	1·93	6	2·44	9
	Modderfontein	4·94	7	6·14	17	1·99	6	2·88	12
Rustenburg ...	Rustenburg	4·56	7	6·44	14	–	—	–	—
Standerton ...	Standerton	3·67	7	5·98	21	–	—	—	—
Swaziland ...	Mbabane...	3·22	19	8·65	46	3·49	13	6·14	27
Wakkerstroom	Volksrust	6·28	8	8·95	22	3·07	9	4·38	17
Waterberg ...	Nylstroom	3·17	6	3·92	11	2·18	5	3·25	7
Witwatersrand	Krugersdorp	3·92	8	5·49	15	1·97	8	2·79	12
	Joubert Park, J'burg ...	4·20	7	6·26	21	2·51	7	3·64	13
	Govt. Observatory, J'burg	4·04	7	5·88	18	2·60	8	3·77	13
Wolmaransstad	Wolmaransstad	1·83	7	—	–	—	–	—	—
Zoutpansberg	Pietersburg	1·16	6	1·71	10	1·48	5	2·15	7
	Leydsdorp	2·09	8	2·29	11	–	—	—	–

Summary.—The rainfall of the month of October was deficient in the extreme south-west, and below the average at many places in the east of the Transvaal. It was generally above the average over the centre, west, and south-east, and about the average in the north.

Pretoria and Johannesburg Market Prices.

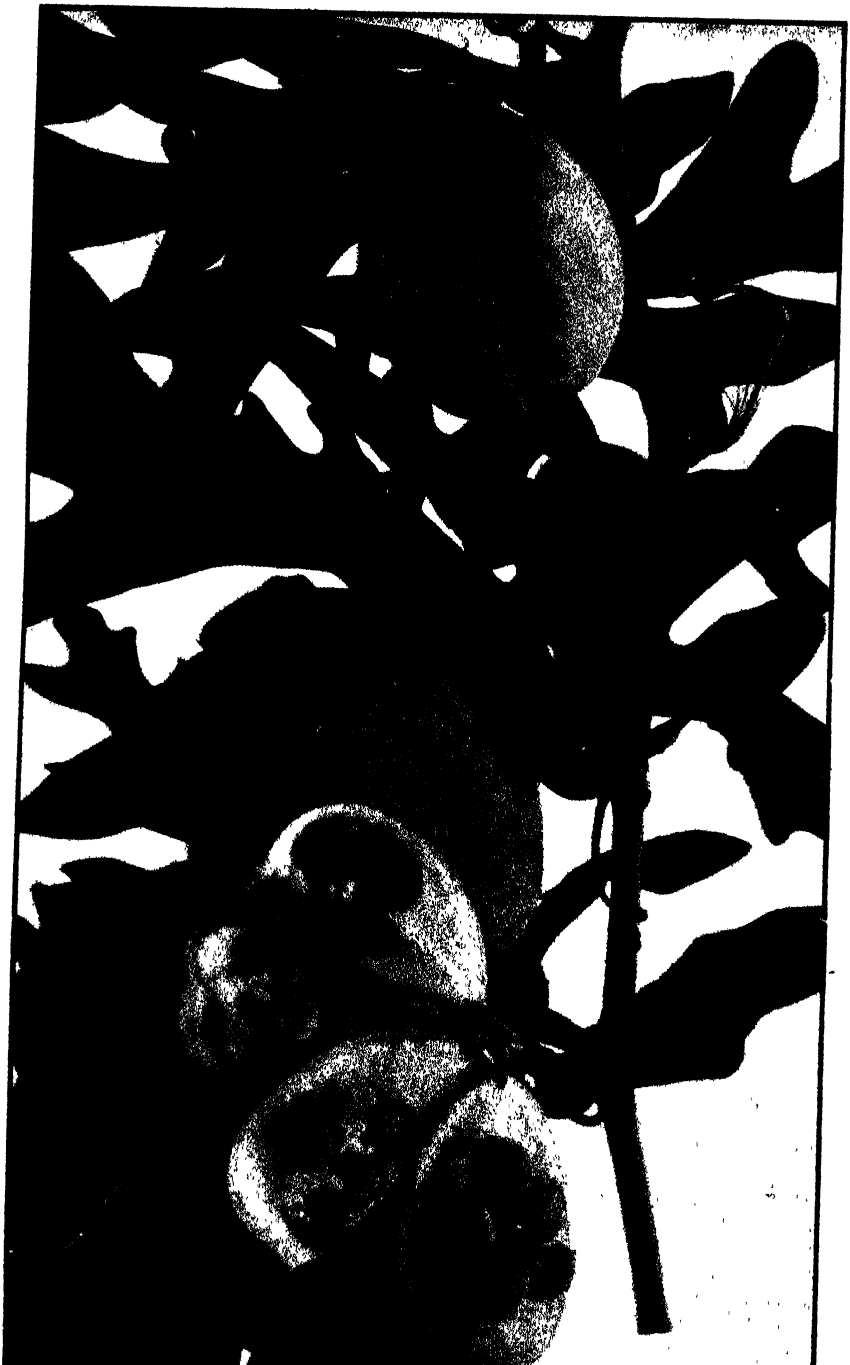
(Produce Prices supplied by the Commercial Agency Co., Limited, Seed and Produce Merchants, No. 116 Vermeulen Street, Telephone No. 165, Box 784, Pretoria; and by Messrs. Hubert Morisse & Co., Produce Merchants and Commission Agents, Loveday and Frederick Streets, Box 63, Johannesburg. Live Stock Prices by Mr. Alfred Webb, Produce Agent to the Cape Government, 1 Parker's Building, Market Street, P.O. Box 2342, Johannesburg.)

PRETORIA.

Description.	*September*, 1908.						*October*, 1908.						*November*, 1908.					
	Lowest.			Highest.			Lowest.			Highest.			Lowest.			Highest.		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
Bran, per bag	0	7	6	0	8	3	0	7	0	0	8	0	0	6	6	0	8	0
Butter, Fresh, per lb. ...	0	1	0	0	1	9	0	1	2	0	1	9	0	1	0	0	1	6
Ducks, each	0	3	3	0	4	4	0	2	9	0	3	9	0	2	6	0	4	0
Eggs, per doz.	0	0	8	0	0	10	0	0	9	0	1	2	0	0	10	0	1	0
,, (fresh) ...	0	0	9	0	1	6	0	1	2	0	1	11	0	1	2	0	2	0
Forage, 100 bundles ...	0	10	3	0	16	6	0	8	9	1	0	0	0	8	6	0	18	6
Fowls, each	0	1	10	0	3	2	0	1	8	0	2	10	0	2	3	0	5	1
Fruit (dried), per lb. ...	0	0	4	0	0	6					—		0	0	6	0	0	7
Geese, each...	0	5	6		—			--			—		0	7	0		—	
Hay, per bale	0	0	4	0	0	9	0	0	8	0	1	2	0	0	8	0	1	5
Kaffir Corn, per bag ...	0	14	9		—		0	12	6	0	13	3	0	15	0	0	17	0
Green Lucerne, per doz. bundles	0	0	9	0	2	0	0	0	9	0	2	3	0	1	0	0	1	9
Manna, per 100 bundles ...	0	4	0	0	7	6	0	9	0		—		0	8	6		—	
White Mealies, per bag ...	0	9	9	0	11	0	0	11	3	0	12	9	0	12	6	0	16	6
Yellow Mealies ,, ...	0	10	9	0	11	9	0	12	0	0	13	6	0	13	9	0	17	0
Onions, per bag	0	18	0	1	2	0	0	18	0	1	5	6	0	7	6	0	11	0
Pigs, each	2	14	0	3	17	0	1	9	0	3	15	0		—			—	
Pigeons, each		—			—		0	0	9		—			—			—	
Pumpkins, each	0	0	9	0	1	6		—			—		0	0	9		—	
Potatoes, per bag	0	19	0	1	15	0	0	13	0	1	18	0	0	14	0	2	0	0
,, (sweet), per bag ...	0	5	9	0	7	6	0	5	0	0	12	6	0	4	0		—	
Oats (seed), per bag ...	0	9	9		—		0	9	0	0	10	3		—			—	
Boer Meal, per bag ...	1	8	6		—			.			—		1	5	9	1	7	0
Turkeys, each	0	3	6	0	11	0	0	7	9	0	16	6	0	5	0	0	13	9
Muscovies, each	0	2	6	0	3	2	0	2	0	0	2	6	0	2	3	0	3	3
Tobacco, per roll	0	0	4	0	0	6	0	0	3½	0	0	5		—			—	
,, cut, per lb. ...	0	0	3		—			—			—		0	0	3		—	
Wheat, per bag	1	3	0		.		1	2	3	1	4	0	1	1	6	1	2	0
Firewood, per load ...	0	9	0	1	17	6	0	12	0	2	12	0	0	15	0	3	4	0
Chaff (pressed) per bale ...	0	0	6	0	1	6	0	1	4	0	1	6	0	0	8	0	1	5
Monkey Nuts, per bag ...	0	12	6		—		0	11	0		—		0	9	0		—	
Hay, Sweet		—			—			—			—		0	1	5	0	2	7

JOHANNESBURG.

Description.	*September*, 1908.						*October*, 1908.						*November*, 1908.					
	Lowest.			Highest.			Lowest.			Highest.			Lowest.			Highest.		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
Barley, per 163 lbs. ...	0	7	6	0	8	6	0	7	6	0	9	6	0	8	6	0	9	6
Bran, per 100 lbs. (Colonial)	0	7	3	0	7	9	0	7	0	0	7	9	0	7	0	0	7	6
Chaff, best, per 100 lbs. ...	0	2	6	0	3	0	0	2	6	0	4	6	0	2	0	0	4	9
„ medium „ ...	0	2	0	0	2	3	0	2	0	0	2	9	0	2	6	0	3	0
Eggs, per doz. (Colonial) ...	0	0	9	0	0	10	0	0	9	0	1	2	0	0	6	0	1	3
Salt, per bag	0	4	6	0	6	3	0	4	9	0	6	3	0	4	9	0	6	0
Forage (Transvaal) ...	0	4	0	0	5	6	0	4	6	0	7	3	0	4	6	0	6	9
„ (Colonial), best, 100 lbs	0	5	6	0	6	0	0	5	0	0	7	0	0	5	3	0	6	9
„ „ med. „	0	3	6	0	4	6	0	3	9	0	6	6	0	4	0	0	5	9
S. Meal, best fine	1	6	0	1	7	9	1	6	0	1	8	6	1	6	0	1	7	6
Rye	0	11	0	0	12	0	0	11	6	0	13	0	0	13	0	0	14	6
Wheat	0	19	0	1	0	6	0	18	6	1	1	0	0	18	6	0	19	6
Mealies, Hickory King Whites	0	10	11	0	11	3	0	11	0	0	13	7	0	15	2	0	16	11
„ (O.R.C.), Whites ...	0	10	10	0	11	0	0	10	7	0	13	0	0	15	0	0	16	11
„ Yellow ...	0	11	0	0	11	6	0	11	6	0	12	10	0	14	6	0	16	11
Kaffir Corn, per 203 lbs. ...	0	11	9	0	13	6	0	12	6	0	13	6	0	14	0	0	16	6
Hay, sweet (Transvaal) ...	0	1	9	0	2	6	0	2	6	0	3	6	0	3	0	0	3	6
Lucerne, per 100 lbs. ...	0	7	6	0	8	3	0	3	6	0	7	9	0	4	0	0	6	9
Manna	0	3	0	0	4	0	0	3	9	0	5	9	0	4	0	0	4	9
Transvaal Hay	0	0	6	0	1	5	0	0	6	0	1	6	0	1	3	0	1	10
Oats, per 153 lbs.	0	7	3	0	10	0	0	8	0	0	10	6	0	9	9	0	12	6
Potatoes, best, per 153 lbs.	1	3	6	1	7	6	1	3	6	2	2	0	0	14	0	1	8	0
„ med. „ ...	0	19	6	1	3	6	0	13	0	1	6	0	0	6	0	1	1	0
„ inferior „ ...	0	15	0	0	19	0	0	13	0	1	4	0	0	6	0	1	1	0
Onions, per 120 lbs. (Colonial)	1	0	0	1	3	0	0	18	0	1	10	0	0	6	0	1	4	6
Turkeys, cocks	0	6	0	0	10	6	0	5	0	0	18	0	0	6	9	0	14	0
„ hens	0	5	0	0	6	0	0	4	0	0	7	6	0	4	9	0	6	6
Fowls	0	1	10	0	4	6	0	1	0	0	4	3	0	1	4	0	4	0
Ducks	0	2	6	0	3	6	0	2	2	0	3	0	0	2	3	0	3	5
Geese		—			—		0	4	6	0	6	3	0	4	3	0	6	0
Pigeons	0	0	8	0	0	9	0	0	8	0	0	10	0	0	8	0	0	9
Butter (O.R.C.), per lb. ...	0	1	0	0	1	6	0	1	0	0	1	6	0	0	9	0	1	3
Pumpkins, each	0	0	4	0	0	6	0	0	6	0	1	0	0	0	6	0	0	9
Beans, per 200 lbs. (sound)	0	13	0	2	6	0	0	14	6	2	6	0	0	14	6	2	6	0
Boer Goats	0	12	0	1	3	0	0	12	0	1	3	0	0	14	0	1	3	0
Donkeys	5	10	0	6	10	0	5	10	0	6	15	0	5	10	0	7	0	0
Oxen (slaughter)	8	10	0	15	0	0	9	0	0	18	0	0	8	0	0	18	0	0
„ (dressed), 100 lbs. ...	1	10	0	1	16	0	1	15	0	2	2	6	1	15	0	2	0	0
Pigs, live, per lb.	0	0	2½	0	0	4	0	0	2¾	0	0	3¾	0	0	2¾	0	0	4
Sheep (hamels)	0	12	0	1	4	0	0	14	0	1	5	0	0	14	0	1	4	6
„ (dressed), per lb. ...	0	0	4¼	0	0	5¾	0	0	5	0	0	6	0	0	5	0	0	5½



A Dangerous Poisonous Plant.

[*Adenia* sp. (*Modecca digitata*); family Passifloraceæ.]

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The Immunity of Horses against Horse-Sickness.

By DR. A. THEILER, C.M.G., Government Veterinary Bacteriologist.

THE following article refers simply to the immunity of horses as I have met with it in my experiments, undertaken for the purpose of finding a method of immunisation against this disease. No mention will be made here as to how this immunity is obtained, as this will form the subject of a special article as soon as the experiments have reached a satisfactory conclusion. The object is principally to point out that in horses a similar observation has been made to that which I explained in my last paper in this *Journal*,* under the title "The Immunity of Mules against Horse-sickness."

EXPLANATION OF TABLES.

The following tables include all horses which survived the immunisation against horse-sickness from September, 1902, to date, and which were subsequently tested. The results of the immunisation do not enter within the scope of this article, and therefore have been omitted, and similarly horses which died whilst undergoing immunisation do not appear:—

Column No. 1 shows the number of horses which have been immunised with the strain of virus named in Column No. 2.

Columns Nos. 3 and 4 refer to the strain of virus used for testing purposes, and the last seven columns show the results of this test.

R. means that the test caused the horse to pass through a fever reaction which, by the temperature chart, had to be considered typical for horse-sickness.

* Vol. VII, No. 26, p. 175, January, 1909.

? means that the temperature did not indicate a typical horse-sickness reaction, and it was doubtful whether the animal was suffering from this disease or whether some other agency was in force, the cause of which could not be ascertained.

RD. means that the lesions of a dik-kop were present, in addition to a typical fever reaction.

R.† means that the animal passed through a horse-sickness reaction and died.

RD.† means that the animal passed through a horse-sickness reaction, accompanied with the lesions of a dik-kop, and died.

No Reaction means that no signs of illness were observed, and the temperature chart did not show any indications of a fever reaction.

The figures in the column headed "Percentage of Reactions" have been obtained by calculating the percentage of animals which showed Reactions, Doubtful reactions, Reactions and Dik-kop, Reactions and died, and Reactions Dik-kop and died.

The letters and symbols in columns two and three each represent a particular strain of horse-sickness virus, and are used for the sake of brevity. The particulars of these strains are as under:—

SINGLE INJECTIONS.

O., or Ord., represents a virus known as Ordinary, which was collected in the Pretoria District and introduced into practice for the inoculation of mules in 1905.

T., or Tzn., represents a virus collected at Tzaneen from a horse immunised with the Ordinary strain, which had a relapse and died: it was introduced into practice for the inoculation of mules in July, 1906.

In passing this strain of virus through horses and mules it was noted that different results were obtained according to the particular generation, and, as these were very interesting, in many cases in the following tables this Tzaneen strain is referred to under the different generations. Reference is also made to this peculiarity later.

B., or Bul., represents a virus collected from a mule in Bulawayo which had been immunised with the Ordinary strain, and had a relapse and died of horse-sickness.

OTB. This was obtained by injecting a horse with the three vira, O., T., and B., simultaneously. At the height of the fever-reaction the horse was tapped, and in order to distinguish this strain from the simple O. + T. + B., the resulting virus of this one horse was called OTB.

OTBLPW. is a virus obtained in the same way as OTB., the constituents being, in addition, blood from Lydenburg, Piet Retief, Pietersburg (two cases), and Warmbaths, and taken from animals immunised with Ordinary virus, which showed breakdowns.

Spon. (Spontaneous) is a virus made in the same way as OTB., the constituents being blood of about forty horses and mules from all over the Transvaal which died of horse-sickness (natural infection).

Rel., or Relapse, represents a virus collected from a mule immunised with O. strain, which had a relapse and died of horse-sickness at Warmbaths.

CD. (Composite district) is a virus obtained in the same way as OTB., the constituents being (O. + T. + B.) + OTB. + Spon. + OTBLPW.

CD.5 (Composite district), a virus obtained in the same way as OTB., the constituents being blood of immunised and non-immunised horses and mules which died in Pretoria, Potchefstroom, Carolina, Zoutpansberg, Waterberg, Middelburg, Lydenburg, Natal, Rhodesia, Lourenço Marques, Rustenburg + CD. + OTBLPW.

CD.6 (Composite district), a virus obtained in the same way as OTB., the constituents being blood of immunised horses and mules which died of horse-sickness in Natal, Rhodesia, Lourenço Marques, Rustenburg, Pretoria, Middelburg, and Lydenburg.

PV.6 (Polyvalent) is a virus obtained in the same way as OTB., the constituents being O. + T. + CD. + CD.5 + CD.6 + PPR.

PPR (Pietpotgietersrust) is a virus obtained in the same way as OTB., the constituents being blood of four immunised mules which were immunised with O. and CD. virus, and died in Pietpotgietersrust.

Donkey O. is Ordinary virus passed through donkeys.

Horse-donkey is Ordinary virus passed through donkeys and then through a horse.

Donkey-mule is Ordinary virus passed through donkeys and then through a mule.

Tzaneen donkey is the virus from Tzaneen passed through donkeys.

Tzaneen donkey-mule is the virus from Tzaneen passed through donkeys and then through a mule.

Bul. donkey is the virus from Bulawayo passed through donkeys.

Goat virus is Ordinary virus passed through goats, and then through a mule.

Goat virus X. is the Ordinary virus passed through goats.

Double Injections.

O. + T., T. + B., B. + O., etc., represents two separate injections, at different times, of the corresponding vira in the order in which they are given. For instance, O. + T. means that Ordinary virus was injected first of all, and at a later date Tzaneen was given.

Treble Injections.

O. + T. + B., T. + B. + O., etc., represents three separate injections, at different times, of the corresponding virus in the order in which they are given.

(O. + T. + B.). Letters in parentheses represent a simultaneous injection of the three corresponding vira.

Quadruple Injections.

O. + T. + B. + Spon., etc., represents four separate injections, at different times, of the corresponding vira in the order in which they are given.

Sextuple Injections.

O. + Donk. O. + Relapse + Tz. + (O. + T. + B.) + OTBLPW. represents six separate injections, at different times, of the corresponding vira in the order in which they are given.

Character of Strain.

The virus Ordinary strain is capable of producing a horse-sickness reaction, but the immunity given by it is not a complete one, since, as will be shown in the tables, the Tzaneen and other vira will break down this immunity. Hence the Ordinary strain is considered to be of only one value (monovalent). In other words, under the term "monovalent" is understood a virus from one horse which contracted horse-sickness, and which was never mixed with any other virus, and was always used as such in all the experiments represented by this particular strain.

Adequate, or inadequate, refers to the relation between the virus used for testing and that used for immunisation.

For instance, if an animal is immunised with virus O. and tested with virus O., the testing virus is characterised as adequate monovalent; or if Tzaneen is used for the test, this virus is inadequate monovalent to the virus O.

The virus OTB. of one horse, as shown before, contains the three strains O., T., and Bul., and therefore can be considered to be of three values (trevalent).

Virus O. + T. + B., however, is not of the same value as OTB., but represents three simultaneous monovalent injections.

OTBLPW. is a virus of one horse, composed of eight strains, and considered to be octovalent.

Spon., CD., PV.6, etc., are all a virus of one horse. They are of several values, and therefore considered to be polyvalent.

Horses Immunised with a Monovalent Virus—One Injection.

No. of horses.	Immunised with Strain.	Tested. Strain.	Tested. Character of Strain.	Result. R.	?	RD.	R.†	RD.†	No Reaction.	Percentage of Reactions.
107	O.	O.	Adequate monovalent	1	2	—	—	—	104	3
17	O.	T.	Inadequate monovalent	5	—	3	1	1	7	60
9	O.	B.	,, ,,	—	—	3	—	4	2	77
42	O.	Spon	Inadequate polyvalent	2	3	—	—	—	37	12
4	O.	CD.	,, ,,	1	—	—	1	1	1	75
2	O.	T. + Spon.	,, ,,	—	—	1	—	—	1	50
1	Tzaneen— 1st Gen.	Tzaneen— 11th Gen.	Adequate monovalent	1	—	—	—	—	—	100
1	,, ,,	13th ,,	,, ,,	—	—	—	1	—	—	100
6	3rd ,,	12th ,,	,, ,,	1	—	—	1	2	2	66
8	4th ,,	5th ,,	,, ,,	—	—	—	—	—	8	Nil
1	,, ,,	7th ,,	,, ,,	1	—	—	—	—	—	100
3	,, ,,	13th ,,	,, ,,	—	—	—	2	—	1	66
5	,, ,,	18th ,,	,, ,,	—	—	—	—	—	5	Nil
1	5th ,,	,, ,,	,, ,,	—	—	—	—	—	1	Nil
1	,, ,,	21st ,,	,, ,,	1	—	—	—	—	—	100
1	6th ,,	18th ,,	,, ,,	—	—	—	—	—	1	Nil
1	,, ,,	19th ,,	,, ,,	1	—	—	—	—	—	100
9	,, ,,	20th ,,	,, ,,	2	1	2	3	—	1	88
6	,, ,,	21st ,,	,, ,,	3	—	1	—	—	2	66
1	7th ,,	18th ,,	,, ,,	—	—	—	—	—	1	Nil
1	,, ,,	20th ,,	,, ,,	1	—	—	—	—	—	100
6	,, ,,	21st ,,	,, ,,	1	—	1	—	—	4	33
2	,, ,,	22nd ,,	,, ,,	—	—	—	—	—	2	Nil
1	8th ,,	18th ,,	,, ,,	—	—	—	—	—	1	Nil
8	,, ,,	21st ,,	,, ,,	2	—	1	2	1	2	75
15	9th ,,	12th ,,	,, ,,	—	—	1	—	—	14	7
2	12th ,,	3rd ,,	,, ,,	1	—	—	—	—	1	50
1	20th ,,	21st ,,	,, ,,	1	—	—	—	—	—	100
19	Tzn.	O.	Inadequate monovalent	7	—	5	2	—	5	74

HORSES IMMUNISED WITH A MONOVALENT VIRUS—ONE INJECTION—(*continued*).

No. of horses	Immunised with Strain.	Tested. Strain.	Tested. Character of Strain.	Result. R.	?	RD.	R.†	RD.†	No. Reaction.	Percentage of Reactions.
4	„	B.	„ „	2	—	1	—	—	1	75
5	„	PPR.	„ „	3	—	1	—	—	1	80
3	„	OTBLPW.	Inadequate octovalent	1	—	—	—	—	2	33
43	„	CD.	Inadequate polyvalent	29	—	7	5	—	2	95
3	„	CD.6	„ „	1	—	1	—	—	1	66
34	„	PV.6	„ „	13	—	1	1	—	19	44
4	Bul.	Bul.	Adequate monovalent	1	—	—	—	—	3	25
1	„	Ord.	Inadequate monovalent	1	—	—	—	—	—	100
2	„	Tzn.	„ „	—	—	—	1	—	1	50
1	„	OTB.	Inadequate trevalent	—	—	—	1	—	—	50
7	Donkey O.	O.	Adequate monovalent	2	—	—	1	—	4	43
1	Donkey O.	Bul.	Inadequate monovalent	—	—	—	1	—	—	100
3	„	Spon.	Inadequate polyvalent	1	—	1	—	—	1	66
4	Horse-donkey O.	O.	Adequate monovalent	—	—	—	—	—	4	Nil
2	Horse-donkey O.	Tzn.	Inadequate monovalent	—	—	—	—	1	1	50
4	„	Bul.	„ „	—	—	—	1	—	3	25
1	Donkey-mule O.	Tzn.	„ „	—	—	—	1	—	—	100
1	„	Bul.	„ „	—	—	—	1	—	—	100
2	Tzn. donkey	O.	„ „	—	—	—	1	—	1	50
1	„	Bul.	„ „	—	—	—	—	—	1	Nil
1	„	OTB.	Inadequate trevalent	—	—	—	1	—	—	100
1	„	PV.6	Inadequate polyvalent	1	—	—	—	—	—	100
3	Bul. donkey	O.	Inadequate monovalent	2	—	—	—	—	1	66
5	Tzn. donkey-mule	Tzn.	Adequate monovalent	1	—	1	1	2	—	100
1	„ „	OTB.	Inadequate trevalent	—	—	—	1	—	—	100
1	Ord. goat virus O.	O.	Adequate monovalent	—	—	—	—	—	1	Nil
4	„ „	„	„ „	—	—	—	—	—	4	Nil
2	Relapse	Tzn.	Inadequate monovalent	2	—	—	—	—	—	100
2	„	B.	„ „	—	—	—	—	—	2	Nil
427				92	6	31	30	12	256	40

HORSES IMMUNISED WITH A MONOVALENT VIRUS—ONE INJECTION.

O. Virus.

The reaction given by one horse immunised with O., and tested with the same strain, is so contrary to my previous experience with this virus that I am hardly inclined to consider the reaction as being due to the test. The animal was tested at the Daspoort Laboratory, and directly after injection it was sent to our farm at Onderstepoort, near Pretoria, a well-known place for horse-sickness, and at a time when the disease was prevalent. I, therefore, am of opinion that the animal reacted to a natural infection, and not to the second injection of O. virus.

The two doubtful reactions can be safely excluded. There are so many other agencies at work that unless the temperature chart shows a fever reaction typical for horse-sickness, or if a dik-kop is present, it is extremely difficult to differentiate between the real disease and a fever reaction, which, in my opinion, is of a mere ephemeral nature.

"*The strain O. protects against subsequent injections of this virus, but the immunity is not complete. Tests with inadequate vira caused 35 per cent. reactions.*"

Of the monovalent virus, the Bulawayo strain seems to differ to the greatest extent, whereas the virus Spontaneous, which represents only 12 per cent., seems to correspond more with the O. virus.

This can perhaps be explained when it is remembered that of the spontaneous cases, although a great number were collected, were always of horses and mules which contracted the disease spontaneously, whereas the Tzaneen and Bulawayo strains were of horses and mules already immunised with O. virus, and must naturally differ in character. The same applies to the virus CD.

Tzaneen Virus

The Tzaneen indicates a most peculiar behaviour. Here we notice that the immunity which is obtained by the injection of this virus of an earlier generation may be broken to the extent of 38 per cent. when injected with a later generation. This clearly demonstrates that the Tzaneen virus undergoes a variation as it passes from the various generations, but the results are in no way consistent. Some generations higher in the scale do not seem to be more virulent than the generation with which the horse was immunised lower in the scale, so that it seems that the virus varies as it passes through a particular horse, although, as it will appear from the table, this variation takes place the higher the horse is in the scale of the generation.

The immunity obtained with the Tzaneen virus was easily broken by any monovalent virus to a great extent, and this will indicate the difference in the character of these monovalent strains. The immunity obtained from Tzaneen is broken by the polyvalent strains to the extent of 66 per cent., thus indicating that the polyvalent strain is very virulent.

Bulawayo Virus.

The strain Bulawayo protects against subsequent injections of this virus, but the immunity is not complete.

Donkey Virus.

The virus O. passed through donkeys, and the virus O. through donkeys and into a mule or into a horse, and that of Bulawayo and Tzaneen show relapses to the extent of 54 per cent. when subsequently tested, including the tests with adequate virus.

Goat Virus.

The immunity obtained from goat virus O. protects against the O. strain.

Relapse Virus.

Tzaneen virus caused 100 per cent. reactions, showing that there must be a difference in their nature, whereas the Bulawayo did not break the immunity, and indicates that the Relapse virus is closer related to the Bulawayo than to the Tzaneen virus.

General.

Of 427 horses immunised with a monovalent virus, and tested with an adequate or inadequate monovalent or polyvalent virus, 40 per cent. showed reactions and 10 per cent. died.

Horses Immunised with a Monovalent Virus—Two Injections.

No. of horses.	Immunised with Strain.	Tested. Strain.	Tested. Character of Strain.	Result. R.	?	RD.	R.†	RD.†	No Re-action.	Per-centage of Re-actions.
8	O. + T.	O.	Adequate monovalent	—	—	—	—	—	8	Nil
6	,,	B.	Inadequate monovalent	2	1	—	—	1	2	66
2	,,	OTBLPW.	Inadequate octovalent	—	—	—	—	—	2	Nil
2	O. + B.	,,	,, ,,	—	—	—	—	—	2	Nil
1	T. + O.	O.	Adequate monovalent	—	—	—	—	—	1	Nil
5	,,	B.	Inadequate monovalent	1	—	1	—	—	3	60
1	,,	OTBLPW.	Inadequate octovalent	1	—	—	—	—	—	100
6	,,	PV.6	Inadequate polyvalent	1	—	—	—	—	5	16
	Tzaneen—	Tzaneen—								
2	4th + 5th Gen.	2nd Gen.	Adequate monovalent	—	—	—	—	—	2	Nil
1	4th + 7th ,,	20th ,,	,, ,,	1	—	—	—	—	—	100
1	4th + 18th ,,	19th ,,	,, ,,	—	—	1	—	—	—	100
2	4th + 18th ,,	20th ,,	,, ,,	—	—	—	2	—	—	100
1	6th + 19th ,,	26th ,,	,, ,,	—	—	—	—	—	1	Nil
2	6th + 20th ,,	21st ,,	,, ,,	2	—	—	—	—	—	100
1	6th + 20th ,,	22nd ,,	,, ,,	—	—	—	—	—	1	Nil
2	6th + 21st ,,	23rd ,,	,, ,,	—	—	—	—	—	2	Nil
1	6th + 21st ,,	24th ,,	,, ,,	—	—	—	—	—	1	Nil
2	6th + 21st ,,	25th ,,	,, ,,	—	—	—	1	—	1	50
1	7th + 20th ,,	22nd ,,	,, ,,	—	—	—	—	—	1	Nil
1	7th + 21st ,,	22nd ,,	,, ,,	1	—	—	—	—	—	100
1	7th + 21st ,,	24th ,,	,, ,,	—	—	1	—	—	—	100
2	7th + 21st ,,	25th ,,	,, ,,	—	—	—	1	1	—	50
2	7th + 22nd ,,	25th ,,	,, ,,	—	—	—	—	—	2	Nil
2	8th + 21st ,,	22nd ,,	,, ,,	—	—	—	—	—	2	Nil
2	8th + 21st ,,	23rd ,,	,, ,,	—	—	—	—	—	2	Nil
13	9th + 12th ,,	30th ,,	,, ,,	—	—	1	5	2	5	62
1	20th + 21st ,,	26th ,,	,, ,,	—	—	—	—	—	1	Nil
2	T. + B.	O.	Inadequate monovalent	1	—	—	—	—	1	50

Horses Immunised with a Monovalent Virus—Two Injections—(*continued*).

No. of horses.	Immunised with Strain.	Tested. Strain.	Tested. Character of Strain.	Result. R.	Result. ?	Result. RD.	Result. R.†	Result. RD.†	Result. No. Reaction.	Percentage of Reactions.
1	T. + B.	T.	Adequate monovalent............	1	—	—	—	—	—	100
1	T. + PPR.	O.	Inadequate monovalent...........	—	—	—	—	—	1	Nil
5	„	PPR.	Adequate monovalent...........	—	—	—	—	—	5	Nil
1	B. + T.	O.	Inadequate monovalent...........	1	—	—	—	—	—	100
1	B. + O.	OTB.	Inadequate trevalent...........	—	1	—	—	—	—	100
2	Rel. + Tzn.	O.	Inadequate monovalent...........	—	—	—	—	—	2	Nil
1	Donkey O. + O....	T.	„ „	—	—	—	—	—	1	Nil
1	„ „ ...	B.	„ „	—	—	1	—	—	—	100
3	„ „ ...	Spon.	Inadequate polyvalent...........	—	1	—	—	—	2	33
1	„ „ ...	T. + Spon.	„ „	1	—	—	—	—	—	100
1	Horse-donk. O. + O.	T.	Inadequate monovalent...........	1	—	—	—	—	—	100
1	Horse-donk. O. + T.	B.	„ „	—	—	—	—	1	—	100
3	Horse-donk. O. + B.	B.	Adequate monovalent............	—	—	1	—	—	2	33
1	„ „ ...	OTB.	Inadequate trevalent...........	—	—	—	—	—	1	Nil
1	Horse-donk. O. + O.	Spon.	Inadequate polyvalent...	—	—	—	—	—	1	Nil
1	T. donk. + T.	T.	Adequate monovalent............	—	—	—	—	—	1	Nil
1	T. donk. + B.	O.	Inadequate monovalent...........	—	—	—	1	—	—	100
1	T. donk.-mule + T..	OTB.	Inadequate trevalent...........	—	—	—	1	—	—	100
1	Bul. donk. + O.....	T.	Inadequate monovalent...........	—	—	—	—	—	1	Nil
1	„ „	OTB.	Inadequate trevalent...........	—	—	—	—	—	1	Nil
1	O. virus goats + O.	Spon.	Inadequate polyvalent...........	—	—	—	—	—	1	Nil
2	Virus X. + O......	„	„ „	—	—	—	—	—	2	Nil
1	„ „	O. + T.	Inadequate monovalent...........	—	—	—	—	—	1	Nil
106				14	3	6	11	5	67	37

HORSES IMMUNISED WITH MONOVALENT VIRUS.—TWO INJECTIONS.

TZANEEN.

Here again the Tzaneen virus shows the same peculiar feature. Horses which were immunised twice, or which had received two injections with Tzaneen lower and higher generations, still showed that they were susceptible to a subsequent inoculation of a higher generation. In this particular instance the highest generation seems to be the most virulent.

GENERAL.

The immunity obtained with two inadequate vira protects as a rule against a subsequent injection of an adequate constituent.

There are, however, exceptions as shown in the table. The immunity against an inadequate monovalent or polyvalent virus shows breakdowns amounting to 37 per cent. and deaths to 15 per cent.

HORSES IMMUNISED WITH A MONOVALENT VIRUS—THREE INJECTIONS.

No. of horses.	Immunised with Strain.	Tested. Strain.	Tested. Character of Strain.	Result. R.	?	RD.	R.†	RD.†	No Reaction.	Percentage of Reactions.
1	O. + T. + B.	O.	Adequate monovalent	—	—	—	—	—	1	Nil
1	„	OTB.	Inadequate trevalent	—	—	—	—	—	1	Nil
1	T. + O. + B.	O.	Adequate monovalent	—	—	—	1	—	—	100
	Tzaneen—	Tzaneen—								
1	4th + 7th + 20th Gen.	21st Gen.	„ „	1	—	—	—	—	—	100
1	6th + 19th + 26th „	31st „	„ „	—	—	—	—	—	1	Nil
1	6th + 20th + 22nd „	29th „	„ „	—	—	—	—	—	1	Nil
1	6th + 21st + 24th „	29th „	„ „	1	—	—	—	—	—	100
1	6th + 21st + 25th „	29th „	„ „	—	—	—	—	—	1	Nil
1	7th + 20th + 22nd „	29th „	„ „	—	—	—	—	—	1	Nil
1	7th + 22nd + 25th „	27th „	„ „	—	—	—	—	—	1	Nil
1	7th + 21st + 22nd „	29th „	„ „	1	—	—	—	—	—	100
2	8th + 21st + 22nd „	29th „	„ „	—	—	—	1	—	1	50
1	8th + 21st + 23rd „	29th „	„ „	—	—	—	—	—	1	Nil
2	9th + 12th + 30th „	32nd „	„ „	—	—	—	1	—	1	50
1	20th + 21st + 26th „	26th „	„ „	—	—	—	—	—	1	Nil
1	20th + 21st + 26th „	31st „	„ „	—	—	—	—	—	1	Nil
2	T. + B. + O.	OTBLPW.	Inadequate octovalent	1	—	—	—	—	1	50
1	B. + T. + O.	„	„ „	—	—	—	—	—	1	Nil
1	Donk. O. + O. + Tzn.	O.	Adequate monovalent	—	—	—	—	—	1	Nil
1	Donk. O. + O. + Bul.	Tzn.	Inadequate monovalent	—	—	—	—	—	1	Nil
1	„ „	Bul.	Adequate monovalent	—	—	—	—	—	1	Nil
1	Horse-donk. O. + O. + T.	O.	„ „	—	—	—	—	—	1	Nil
1	Bul. donk. + O. + T.	„	„ „	—	—	—	—	—	1	Nil
1	Relapse + T. + O.	B.	Inadequate monovalent	—	—	—	—	—	1	Nil
27				4	—	—	3	—	20	27

HORSES IMMUNISED WITH A MONOVALENT VIRUS.—THREE INJECTIONS.

TZANEEN.

Horses immunised with Tzaneen strain in three injections of three different generations of virus obtained an immunity which was broken by the injection of the same strain, but of a higher generation to the extent of 33 per cent.

The percentage of deaths amounted to 13 per cent.

GENERAL.

Horses inoculated three times with two or three different monovalent vira, excluding Tzaneen pure, and tested with monovalent and polyvalent, adequate, and inadequate virus, showed reactions to the extent of 14 per cent.

The percentage of deaths amounted to 8 per cent.

HORSES IMMUNISED WITH A MONOVALENT VIRUS—FOUR INJECTIONS.

No. of horses.	Immunised with Strain.	Tested.		Result.						Percentage of Reactions.
		Strain.	Character of Strain.	R.	?	RD.	R.†	RD.†	No Reaction.	
1	Tz. 4 + 7 + 20 + 21 Gen.	Tz. 29th Gen.	Adequate monovalent..........	—	—	—	—	—	1	Nil
1	Relapse + T. + O. + B..	O.	,, ,, ...	—	—	—	—	—	1	Nil
1	,, ,, ..	B.	,, ...	—	—	—	—	—	1	Nil
3				—	—	—	—	—	3	Nil

Result: Total percentage of reactions, Nil. Total percentage of deaths, Nil.

Horses Immunised with a Trevalent Virus—One Injection.

No. of horses.	Immunised with Strain.	Tested.		Result.						Percentage of Reactions.
		Strain.	Character of Strain.	R.	?	RD.	R.†	RD.†	No Reaction.	
1	OTB	O.	Adequate monovalent	—	—	—	—	—	1	Nil
1	,,	CD.	Inadequate polyvalent	—	—	—	—	—	1	Nil
2				—	—	—	—	—	2	Nil

Result: Total percentage of reactions, Nil. Total percentage of deaths, Nil.

Horses Immunised with an Octovalent Virus—One Injection.

No. of horses.	Immunised with Strain.	Tested.		Result.						Percentage of Reactions.
		Strain.	Character of Strain.	R.	?	RD.	R.†	RD.†	No Reaction.	
1	OTBLPW	Tzn.	Adequate monovalent	—	—	—	—	—	1	Nil
1	,,	OTBLPW.	Adequate octovalent	—	—	—	—	—	1	Nil
12	,,	CD.	Inadequate polyvalent	2	—	—	—	—	10	16
14				2	—	—	—	—	12	14

Result: Total percentage of reactions, 14. Total percentage of deaths, Nil.

Horses Immunised with a Polyvalent Virus—One Injection.

No. of horses.	Immunised with Strain.	Tested. Strain.	Tested. Character of Strain.	Result. R.	?	R.D.	R.†	R.D.†	No Reaction.	Percentage of Reactions.
7	Spon.	O.	Inadequate monovalent	1	—	—	—	—	6	14
4	,,	T.	,, ,,	1	—	1	1	1	—	75
1	,,	B.	,, ,,	—	—	1	—	—	—	100
4	,,	Spon.	Adequate polyvalent	—	—	—	—	—	4	Nil
7	,,	CD.	Inadequate polyvalent	2	—	—	2	—	3	43
1	,,	O. + Spon.	,, ,,	—	—	—	—	—	1	Nil
1	CD.	O.	Inadequate monovalent	—	—	—	1	—	—	100
2	,,	Tzn.	,, ,,	—	—	1	1	—	—	100
8	,,	CD.	Adequate polyvalent	—	—	—	—	—	8	Nil
3	,,	CD.5	Inadequate polyvalent	—	—	—	—	—	3	Nil
1	PV.6	O.	Adequate monovalent	—	—	—	—	—	1	Nil
4	,,	T.	,, ,,	1	—	—	—	—	3	25
1	,,	PPR.	,, ,,	—	—	—	—	—	1	Nil
4	,,	CD.6	Adequate polyvalent	—	—	—	—	—	4	Nil
1	Virus Mix. I.	CD.	Inadequate polyvalent	—	—	—	—	—	1	Nil
1	Virus Mix. II.	,,	,, ,,	—	—	—	—	—	1	Nil
50				5	—	3	5	1	36	28

Result: Total percentage of reactions, 28. Total percentage of deaths, 12.

Horses Immunised with a Polyvalent Virus—Two Injections.

No. of horses.	Immunised with Strain.	Tested.		Result.						Percentage of Reactions.
		Strain.	Character of Strain.	R.	?	RD.	R.†	RD.†	No Reaction.	
7	O. + Spon.	O.	Adequate monovalent	—	—	—	—	—	7	Nil
21	,,	Tzn.	Inadequate monovalent	5	—	1	—	5	10	52
10	,,	Bul.	,, ,,	2	—	1	—	—	7	30
3	,,	T. + Spon.	Inadequate polyvalent	2	—	1	—	—	—	100
1	O. + CD.	CD.4	,, ,,	—	—	—	—	—	1	Nil
2	Tzn. + OTBLPW.	CD.	,, ,,	—	—	—	—	—	2	Nil
1	Tzn. + CD.	PPR.	Inadequate monovalent	—	—	—	—	—	1	Nil
34	,,	CD.	Adequate polyvalent	1	—	—	—	—	33	3
4	,,	CD.5	Inadequate polyvalent	—	—	—	—	—	4	Nil
3	Tzn. + CD.6	CD.6	Adequate polyvalent	2	—	1	—	—	—	100
13	Tzn. + PV.6	O.	Adequate monovalent	4	—	—	2	—	7	45
5	,,	Tzn.	,, ,,	—	—	1	—	—	4	20
5	,,	PPR.	,, ,,	—	—	—	—	—	5	Nil
4	,,	CD.6	Adequate polyvalent	—	—	—	—	—	4	Nil
1	Donk. O. + Spon.	Tzn.	Inadequate monovalent	—	—	1	—	—	—	100
2	,, ,,	Bul.	,, ,,	—	—	—	1	—	1	50
1	OTB. + O.	OTBLPW.	,, ,,	—	—	—	—	—	1	Nil
1	OTB. + CD.	Tzn.	Adequate monovalent	—	—	—	—	—	1	Nil
2	OTBLPW. + CD.	,,	,, ,,	—	—	—	1	—	1	50
2	,, ,,	CD.	Adequate polyvalent	—	—	—	—	—	2	Nil
3	,, ,,	CD.5	Inadequate polyvalent	—	—	—	—	—	3	Nil

HORSES IMMUNISED WITH A POLYVALENT VIRUS—TWO INJECTIONS—(*continued*).

No. of horses.	Immunised with Strain.	Tested.		Result.						Percentage of Reactions.
		Strain.	Character of Strain.	R.	?	RD.	R.†	RD.†	No Reaction.	
1	OTBLPW. + CD.	CD.6	Inadequate polyvalent	—	—	—	—	—	1	Nil
3	Spon. + O.	Tzn.	Inadequate monovalent	3	—	—	—	—	—	100
2	"	Bul	" "	—	—	—	—	2	—	100
1	"	CD.5	Inadequate polyvalent	—	—	—	—	—	1	Nil
1	Spon. + T	O.	Inadequate monovalent	—	—	—	—	—	1	Nil
1	Spon. + B.	OTB.	Inadequate trevalent	—	—	—	—	—	1	Nil
2	Spon. + CD.	CD.	Adequate polyvalent	—	—	—	1	—	1	50
2	"	CD.4	Inadequate polyvalent	—	—	—	—	—	2	Nil
1	CD. + Tzn.	Tzn.	Adequate monovalent	—	—	—	1	—	—	100
2	PV.6 + Tzn.	O.	" "	—	—	—	—	—	2	Nil
2	"	Tzn.	" "	—	—	—	—	—	2	Nil
1	PV.6 + PPR.	"	" "	—	—	—	—	1	—	100
1	PV.6 + CD.6	O.	" "	—	—	—	—	—	1	Nil
2	"	Tzn.	" "	1	—	1	—	—	—	100
1	Virus Mix. I + CD.	CD.5	Inadequate polyvalent	—	—	—	—	—	1	Nil
1	Virus Mix. II + CD.	O.	Adequate monovalent	—	—	—	—	—	1	Nil
1	" "	CD.	Adequate polyvalent	—	—	—	—	—	1	Nil
150				20	—	7	6	8	109	28

Result: Total percentage of reactions, 28. Total percentage of deaths, 9.

HORSES IMMUNISED WITH A POLYVALENT VIRUS—THREE INJECTIONS.

No. of horses.	Immunised with Strain.	Tested. Strain.	Tested. Character of Strain.	Result. R.	?	RD.	R.†	RD.†	No Reaction.	Percentage of Reactions.
12	O. + T. + Spon.	O.	Adequate monovalent	1	—	2	—	—	9	25
2	" "	B.	Inadequate monovalent	—	—	—	—	—	2	Nil
6	O. + Spon. + B.	OTB.	Inadequate trevalent	—	—	—	—	—	6	Nil
2	" "	OTBLPW.	Inadequate octovalent	1	—	—	—	—	1	50
1	O. + CD. + CD.4.	O.	Adequate monovalent	—	—	—	—	—	1	Nil
1	T. + O. + PV.6.	Tzn.	" "	—	—	—	—	—	1	Nil
1	T. + CD. + CD.5.	O.	" "	—	—	—	—	—	1	Nil
2	T. + PV.6 + PPR.	"	" "	—	—	—	—	—	2	Nil
1	T. + PV.6 + CD.6.	"	" "	—	—	—	—	—	1	Nil
1	" "	Tzn.	" "	—	—	—	—	1	—	100
2	Donk. O. + O. + Spon.	O.	" "	—	—	—	—	—	2	Nil
1	" "	Tzn.	Inadequate monovalent	1	—	—	—	—	—	100
1	Donk. O. + Spon. + T.	O.	Adequate monovalent	—	—	—	—	—	1	Nil
1	Horse-donk. O. + O. + Spon.	Bul.	Inadequate monovalent	—	—	—	—	1	—	100
1	Bul. donk. + O. + OTB.	OTBLPW.	Inadequate octovalent	—	—	—	—	—	1	Nil
1	OTB. + O. + OTBLPW.	CD.	Inadequate polyvalent	—	—	—	—	—	1	Nil
1	OTBLPW. + O. + T.	Spon. + OTBLPW.	" "	—	—	—	—	—	1	Nil
1	OTBLPW. + CD. + T.	Tzn.	Adequate monovalent	—	—	—	—	—	1	Nil
1	Spon. + O. + T.	O.	" "	—	—	—	—	—	1	Nil
2	" "	B.	Inadequate monovalent	—	—	—	—	—	2	Nil
1	Spon. + B. + OTB.	Spon.	Adequate polyvalent	—	—	—	—	—	1	Nil
1	Spon. + CD. + CD.4.	O.	Adequate monovalent	—	—	—	—	—	1	Nil
2	" "	CD.	Adequate polyvalent	—	—	—	—	—	2	Nil
1	Rel. + T. + O.	B.	Inadequate monovalent	—	—	—	—	—	1	Nil
1	O. Goat virus + O. + Spon.	Tzn.	" "	—	—	—	1	—	—	100
2	Virus X. + O. + Spon.	"	" "	—	1	1	—	—	—	100
49				3	1	3	1	2	39	20

Result: Total percentage of reactions, 20. Total percentage of deaths, 6.

HORSES IMMUNISED WITH A POLYVALENT VIRUS—FOUR INJECTIONS.

No. of horses.	Immunised with Strain.	Tested. Strain.	Tested. Character of Strain.	Result. R.	Result. ?	Result. RD.	Result. R.†	Result. RD.†	Result. No Reaction.	Percentage of Reactions.
1	O. + T. + B. + Spon....	OTB.	Inadequate trevalent..........	—	—	—	—	—	1	Nil
1	„ „ ...	OTBLPW.	Inadequate octovalent.........	—	—	—	—	—	1	Nil
1	O. + B. + Spon. + OTB.	Spon.	Adequate polyvalent.........	—	—	—	1	—	—	100
1	Donk. O. + O. + T. + Sp.	Tzn.	Adequate monovalent..........	—	—	—	—	—	1	Nil
1	„ „	O.	„ „	—	—	—	—	—	1	Nil
1	Donk. O. + O. + Sp. + T.	„	„ „	—	—	—	—	—	1	Nil
1	„ „	Tzn.	„ „	—	—	—	—	—	1	Nil
1	Donk. O. + O. + Sp. + B.	Bul.	„ „	—	—	—	—	—	1	Nil
1	„ „	OTB.	Inadequate trevalent.........	—	—	—	—	—	1	Nil
1	Virus X. + O. + Sp. + T.	Bul.	Inadequate monovalent......	1	—	—	—	—	—	100
1	Spon. — O. + T. + B ...	O.	Adequate monovalent..........	—	—	—	—	—	1	Nil
1	„ „ ...	Tzn.	„ „	—	—	—	—	—	1	Nil
1	„ „ ...	Bul.	„ „	—	—	—	—	—	1	Nil
1	„ „ ...	Spon. + OTBLPW.	Inadequate polyvalent........	—	—	—	—	—	1	Nil
14				1	—	—	1	—	12	14

Result: Total percentage of reactions, 14. Total percentage of deaths, 7.

Exposure Experiments.

The following horses were immunised in the way indicated, and then exposed to natural infection in February and March, 1908. Only results to hand up to the end of February, 1909, have been included.

No. of horses.	Immunised with Strain.	Tested by Exposure in —	Result.						Percentage of Reactions.
			R.	?	RD.	R.†	RD.†	No Reaction.	
	Horse Immunised with a Monovalent Virus—One Injection.								
1	O.	Barberton District	—	—	—	—	—	1	Nil
	Horse Immunised with a Monovalent Virus—Four Injections.								
1	Donk. O. + T. + O. + Bul.	Barberton District	—	—	—	1	—	—	100
	Horses Immunised with a Polyvalent Virus—One Injection.								
4	CD.	Barberton District	—	—	—	—	—	4	Nil
	Horses Immunised with a Polyvalent Virus—Two Injections.								
1	Tzn. + CD.	Barberton District	—	—	—	—	—	1	Nil
4	O. + Spon.	" "	—	—	—	1	—	3	25
2	OTBLPW. + CD.	" "	—	—	—	—	1	1	50
1	Spon. + CD.	" "	—	—	—	—	—	1	Nil
6	Tzn. + CD.	Carolina (Komati Valley) District	—	—	—	—	—	6	Nil
14			—	—	—	1	1	12	14

HORSES IMMUNISED WITH A POLYVALENT VIRUS—THREE INJECTIONS.

1	O. + Spon. + Tzn.	Barberton District	—	—	—	—	—	1	Nil
1	T. + OTBLPW. + CD.	Carolina (Komati Valley) District	—	—	—	—	—	1	Nil
1	Spon. + Bul. + OTB.	Barberton District	—	—	—	—	—	1	Nil
3			—	—	—	—	—	3	Nil

HORSES IMMUNISED WITH A POLYVALENT VIRUS—FOUR INJECTIONS.

1	Donk. O. + Sp + Bul. + OTB.	Barberton District	—	—	—	—	—	1	Nil
1	Spon. + T. + O. + B.	„ „	—	—	—	—	—	1	Nil
1	B. + T. + O. + CD.	Nelspruit	—	—	—	—	—	1	Nil
1	O. + CD. + CD.4 + O.	Barberton District	—	—	—	—	—	1	Nil
1	Tzn. + B. + O. + OTBLPW.	„ „	—	—	—	—	—	1	Nil
1	(O. + T. + B.) + Tzn. + O. + CD.	„ „	—	—	—	—	1	—	100
6			—	—	—	—	1	5	16

HORSES IMMUNISED WITH A POLYVALENT VIRUS—SIX INJECTIONS.

1	O. + Donk. O. + Rel. + Tzn. + (O. + T. + B.) + OTBLPW.	Barberton District	—	—	—	—	—	1	Nil

Result: Of 30 immunised horses exposed in various localities, four had relapses and died, or 13 per cent.

Tabulated Analysis of Results.

No. of Tests.	Immunisation.		Result.			Remarks.
	Character of Virus used.	No. of Injections.	Percentage of Reactions when Tested.	Percentage of Deaths when Tested.	Percentage of Deaths when Exposed.	
427	Monovalent	1	40	10	—	
1	,,	1	—	—	Nil	
106	,,	2	37	15*	—	
27	,,	3	27	11†	—	
3	,,	4	Nil	Nil	—	Animals were tested only with a monovalent adequate virus.
1	,,	4	—	—	100	
2	Trevalent	1	Nil	Nil	—	
14	Octovalent	1	14	Nil	—	
50	Polyvalent	1	28	12	—	
4	,,	1	—	—	Nil	
150	,,	2	28	9	—	
14	,,	2	—	—	14	
49	,,	3	20	6	—	
3	,,	3	—	—	Nil	
14	,,	4	14	7	—	
6	,,	4	—	—	16	
1	,,	6	—	—	Nil	

Of 842 tests, Reactions amounted to 34 per cent

Of 842 tests, Deaths amounted to 10 per cent.

Of 30 animals exposed, Deaths amounted to 13 per cent.

* 11 per cent. of these deaths are due to the Tzaneen strain.

† 7 per cent. of these deaths are due to the Tzaneen strain.

CONCLUSIONS.

1. The experiments show that the immunity obtained by one virus is by no means absolute, inasmuch as breakdowns do occur. These breakdowns must be considered to be due to the injection with a different strain, which is of another nature.

2. The experiments, however, with the Tzaneen strain clearly indicate that the virulency of a strain varies as it passes through the different generations, and it is probable that in practice a similar proceeding takes place, which at the present time we have not been able to follow up. The experiments have to be tested further with the other strains before we can definitely state that such an occurrence takes place with them.

3. The experiments further prove that the immunity can be increased by mixing various strains together and creating a polyvalent strain, and it is clear from the tabulated analysis that the more injections an animal receives, either with a monovalent or with a polyvalent strain, the better the immunity.

4. So far, in experimenting with a number of horses, we have not been able to produce such an immunity that it can in no way, and under no conditions, be broken; and it has, therefore, to be expected that, notwithstanding the number of times an animal has been injected with many different vira of monovalent and polyvalent character, yet a certain percentage of breakdowns will occur. The experience in practice so far shows that these breakdowns have in one year amounted to 13 per cent., and it is at this figure that I am inclined to place the mortality of immunised horses, even when immunised with several monovalent or polyvalent strains.

5. It stands to reason that when we increase the number of injections and increase the polyvalency of a virus the less the subsequent relapses will follow, but I am not prepared to say that by injecting horses several times, and thereby reducing the mortality from relapses, that a complete immunity will be obtained sufficient to protect all injected animals.

6. It is a noteworthy feature in the immunisation and in the test of horses that relapses with dik-kop may occur more than once. In our experiments of 300 horses injected and tested, 194 showed dik-kop once, 46 dik-kop twice, and 1 animal a third dik-kop (15 per cent. horses showing two dik-kops), and these dik-kops have sometimes been noted within three weeks of each other.

Botanical Characters of the Maize Plant.

BY JOSEPH BURTT-DAVY, F.L.S., Government Agrostologist and Botanist.

IN previous articles and in lectures I have frequently pointed out that maize growing can be made much more profitable to South African farmers if we improve our breeds of maize by careful selection. But selection will do little good unless we know what to select. The more we know about the desirable characters the more beneficial will our selection prove from the point of view of profit. To select our seed effectively we must study the maize plant, just as much as we study our sheep before selecting for the stud flock We must know how the maize plant feeds and grows, and what constitutes a healthy mother-plant suitable for seed purposes. For guidance in this respect, therefore, I have written the following article on the characters of the maize plant.

1. Plants are living things, which feed and breathe in order to grow and multiply their kind. Their food-material consists of water, several of the different chemical substances of which the soil is composed, and carbon which is contained in the air.

Plants consist of a vast number of cells of different forms; the cell is a microscopic sac usually consisting of a wall surrounding a jelly-like mass called *protoplasm*. Protoplasm is the living substance of the plant, and consists of various minute, differentiated bodies, some of which (the *chloroplasts*) contain a green colouring matter (*chlorophyll*), and are present in such enormous quantities that they cause the whole plant-surface to appear dark green

In all but the simplest forms of plant life, the cells of which they are composed are not massed together promiscuously, but are associated in groups forming bands, plates, or cylindrical masses. These are called *tissues*.

In the seed-bearing plants and other highly developed forms of plant life, the tissues become differentiated into groups, forming organs, having different duties to perform. Of these organs the most important are the *root*, *stem*, *leaf*, and *flower*.

The maize plant is a large grass, with a tall, stout, solid annual stem, and broad leaves. The flowers are gathered together into inflorescences, which are normally of two kinds, male and female, on the same plant. Sometimes female flowers develop on the male inflorescence and vice versa, and *hermaphrodite* flowers (i.e. flowers containing both male and female organs) are said to occur sometimes.

2. *The Root.*—This is the part of the plant which grows downwards into the soil for the purpose of anchorage and absorption (drawing in) of food materials; it does not bear leaves nor reproductive organs. The water held in the soil dissolves the chemical substances of which the soil is composed. Dilute solutions of these are drawn in through the minute hairs on the younger roots, and are carried up into the plant, where they are chemically changed into the various compounds on which the plant feeds.

Maize is mainly a surface-rooting plant. The general tendency of the roots is to spread horizontally, near the surface, for one or two

feet all round, and then to turn abruptly downwards. As a rule the horizontal roots occur within four inches of the surface. In young plants one to six weeks old, by far the largest part of the root-system is found at a depth of two to four inches from the surface. The indications point to the distribution of the roots being dependent more upon a proper supply of oxygen and water than upon temperature of the soil.

Maize roots have been measured eight feet in *length*, but not in depth. They have been traced to a *depth* of four feet and slightly over, but as a rule most of the root-surface occurs within the first two feet of soil. The following measurements have been recorded:—

Height of plant ½ inch, root 8 inches long.

Height of plant 3 inches, root 13 inches long.

Height of plant 5 inches, root 11 to 24 inches long.

The majority of the permanent roots usually *begin* at about one inch below the surface of the soil, regardless of the depth of planting.

The nodes at the lower portion of the stem above the surface of the soil are often provided with roots, few or many in number, called *adventitious* or "brace roots," some of which grow downward till they reach the soil, and then appear to assist in anchoring the plant. These adventitious roots are more plentiful in some varieties (e.g. Cusco, Mexican, etc.) than in others. In some sorts they occur at a considerable distance up the stem. These may perhaps be kinds which have been accustomed to growing on river banks, subject to floods carrying a deep deposit of river mud, into which the brace roots penetrate.

From the above description of the root system the following points are clear:—First, that the maize plant being a surface feeder requires to have its food supply within a short distance of the surface; second, that deep cultivation while the plants are growing is likely to prune off the surface roots, and thus reduce the absorptive power of the plant; third, that surface-rooting weeds interfere with the supply of moisture and plant-food required by the maize crop.

3. *The Stem.*—The stem grows upwards and bears the leaves and inflorescence. It is made up of a series of lengths or *inter-nodes* connected by joints or *nodes*. Internally it is filled with pith; the hard portion surrounding the pith is composed of a number of fibres called *vascular bundles*, through the woody part of which the solution of water and food material absorbed by the roots travels upwards to the leaves.

The stem of the maize plant is extremely variable in height, ranging from 1½ to 30 feet in different breeds and in different climates; the usual range in South Africa is from about 5 to 14 feet. The circumference of an average stem will range from about 3 to 4½ inches between the first and second nodes, in a dent or flint sort. The inter-nodes are channelled on alternate sides, next the leaf blade and on the side where the branch or ear may occur.

Growth is rapid during favourable climatic conditions. It has been found to range from 3 to 18½ inches per week, and a growth of 5 inches has been recorded on one day under specially favourable conditions.

As in other grasses, the stem wall is rich in silica, which aids in maintaining it in an erect position.

The function of the stem is to carry food materials from the roots to the leaves, and then to other parts of the plant, and to raise the

leaves and inflorescences into the air and light, to facilitate photosynthesis (5) and pollination (13).

4. *Suckers.*—When planted thinly, the maize plant often produces *suckers*; these are branches which arise from the lower nodes below the surface of the soil. Some varieties have a much greater tendency to sucker than others; the tendency appears to be specially strong in crossbreds. These suckers often produce tassels bearing both male and female flowers (Plate 59), which sometimes develop small, round grains. As a rule suckers do not bear proper ears; they are undesirable in crops grown for grain, because they take food and moisture from the soil and give no return except the fodder. Some varieties bear several branches from nodes higher up the culm, but as a rule the culms are unbranched except for the suckers and the shanks of the ears, the shanks being in reality short branches.

5. *The Leaf and its Functions.*—The leaves are borne on the stem, around which the sheath or lower portion is closely wrapped; the broad upper portion which spreads away from the stem is called the *blade*. At the junction of sheath and blade is a projection which tightly clasps the stem, and which is called the *ligule*. To a certain extent, at any rate, the ligule of the maize plant may prevent the entrance of water and soil which might start decay between the sheath and the stem.

In dent maize the number of leaves on a stem usually varies from twelve to eighteen, but as the lower leaves die off before maturity, it may happen that only about twelve function at one time; fifteen is a desirable number. The width of the blade varies from 3¾ to 5⅛ inches. The total external leaf surface of a single maize plant has been measured and found to equal 24 square feet. An acre often carries over 8,500 maize plants, which, with 24 feet of leaf surface each, would yield a total of 204,000 square feet, and which is 4.68 times the area of the soil covered by the crop.

The leaves absorb air into their tissues through microscopic openings called *stomata*. Among other gases of which the air is composed is *carbon-dioxide*, which is composed of the two chemical elements *carbon* and *oxygen*. When the air comes in contact with the chloroplasts in the leaf cells, in the presence of light and moderate warmth, the carbon-dioxide is decomposed, and some of the oxygen is given off again. The carbon is retained, and, combining with the water and chemical substances obtained from the soil through the roots, various complex organic compounds are formed. This chemical action takes place chiefly during the daytime, and only in the presence of light, and is therefore called *photosynthesis*. At night the new compounds are used in the building up of tissue required for the increasing growth of the plant.

The enormous quantity of starch used in the formation of the maize grain must first be chemically formed in the leaf before it is carried to the ear, where it is finally deposited. The importance of the leaf in the life-history of the plant is thus evident. It is literally a chemical laboratory in which the various elements of plant-food are separated out from the compounds in which they originally occur, and are reunited into the only forms in which they can be made use of by the plant. Plants poor in leaf surface, through lack of food or water, or from insect injury or damage from hail, cannot develop as

much grain as those with a proper proportion of leaf. It does not follow, however, that the larger the leaf surface the greater the amount of seed produced. *Beyond a certain proportion* (which perhaps varies in different varieties or breeds), the amount of seed produced seems to decrease in inverse ratio to the increase in leaf surface.

After the food materials are used up, the surplus water in which they were dissolved and carried is *transpired* or given off from the leaf surface, and is replaced by a fresh supply drawn up from the roots. There is thus a large stream of water constantly passing away from the soil into the air, through the leaves of the plant; it soon drains the soil dry unless replaced by rain or irrigation.

6. *The Inflorescence.*—The maize plant is *monœcious*, i.e. it bears the reproductive organs in separate flowers on the same plant. The *staminate* or *male* flowers are usually borne by themselves in the terminal inflorescence called the *tassel;* the *pistillate* or *female* flowers are usually borne on one or more lateral inflorescences called *ears*, at the ends of short branches arising from the *axils* of the leaves (i.e. the junction of leaf and stem).

The separation of male and female flowers into different inflorescences on different parts of the same plant is not constant. When the suckers produce tassels, these usually bear both male and female flowers (Plate 59): this habit is said to be found in some cases also in the tassel of the main culm, especially in the case of pod maize. Branched ears sometimes occur, the terminal portion of the branch bearing male spikelets (see Plate 58).

The maize flower is *anemophilous* (i.e. wind pollinated). The pollen being very light is carried long distances, and there is thus great danger of cross pollination if two varieties are planted near to each other; 400 yards is found a safe distance in the United States. The maize tassel is much visited by bees, which collect the pollen for food for their young larvae. But the bees do not visit the silks (the styles of the female flowers), and are not, therefore, direct agents in pollination. It is probable, however, that they aid to a minor extent in self-pollination of the plants by shaking some of the pollen on to the silks immediately below, at times when the air is too still to carry it away. The amount of pollen produced is o great (10) that the little taken by the bees is not likely to have any injurious effect on the plants. Monœcism promotes cross-pollination. Kerner concludes, however, that its primary purpose is to promote hybridization.

7. *Barren Plants.*—One of the causes of low yield of grain per acre is the occurrence of *barren stems*, i.e. stems which, though they bear tassels, produce no ears. Cases are reported from America of 60 per cent. of barren stems in a crop of maize. This subject has been much discussed by maize breeders, but it is still a moot point whether the tendency to produce barren stems is an inherited character. Some writers, e.g. Hunt, maintain that "if it were an hereditary characteristic the facts that the stalks are barren would tend to eliminate them." If barren stems were absolutely barren, in the strict sense of the word, this would be true, but the fact that they produce tassels and pollen lends colour to the view that they may tend to reproduce their kind.

The percentage of barren stems on a given soil is said to vary with the thickness of planting and the season, and barrenness does not

seem to be a variety characteristic, but rather the result of environment. The subject needs further investigation in South Africa.

8. *Time taken to Reach the Flowering Period.*—Considerable difference is noticeable in different varieties as to the time between germination and flowering; usually it takes nine to eleven weeks. This is an important point for the farmer. A variety which *ripens off* too quickly after flowering may not have time to form a heavy crop of grain; while if the shortening of the time of growth takes place between germination and flowering, it may perhaps not have such an effect on the yield. The shortest period noted by me has been sixty-four days. Variation in this respect may be due in part to difference in amount and time of rainfall.

Most of the varieties studied have also shown great variation in individual plants, as to time of flowering and appearance of the silks.

9. *The Tassel.*—The tassel consists of numerous branches bearing more or less *distichous* rows of staminate *spikelets* which are in pairs, one *pedicellate* (stalked) the other *sessile* (without a stalk). Each spikelet consists of a pair of protective, sheath-like bracts, called *glumes* (Plate 54*a*), which encloses two *florets*. Each floret consists of a pair of thin bracts, the lower or outer of which is called the *valve*, and the upper or inner the *palea*.

Enclosed within the valve and palea of each floret, when in bud, are three *stamens* (Plate 54*a*); there are thus six stamens to each spikelet. When the flowers open, the stamens are *exserted* (pushed out). Each stamen is composed of a long and narrow *anther* hanging freely at the end of a very fine, slender thread, the *filament*. Each anther consists of two sacs, attached side by side, and opening by a pore at the lower end, through which falls out the minute, dust-like, cream-coloured or golden. pollen, which is the medium of sexual reproduction. At the base of the anthers are minute organs, called *lodicules*, which at time of flowering become turgid and press open the valve and palea, allowing the stamens to protrude.

10. *The Pollen and its Vitality.*—Pollen is the fine, yellowish dust which flies in clouds from the tassels when shaken in the early morning. Pollen is essential to the fertilization of the pistillate flowers and the development of the grain. Without it no grain can be formed. This may easily be demonstrated by tying a clean paper bag tightly over an ear, before the silks develop, and leaving it so covered until after they have dried up.

The pollen "dust" consists of an enormous number of roundish grains. Each individual grain is a separate cell, consisting of a cell wall of usually two layers or coats surrounding a mass of protoplasm, which contains two smaller bodies called *nuclei*, one being known as the *vegetative nucleus* and the other as the *generative nucleus*.

A tassel of sugar maize has been found to bear 636 spikelets, containing in all 3,816 stamens, while the more robust "field corns" may carry about 7,200 stamens. The pollen grains produced in one anther have been counted and found to average about 2,500 each. At this proportion the tassel of sugar maize referred to would contain nine and a half million grains of pollen. A tassel of field maize has been estimated to produce 18,000,000 grains, and especially vigorous plants from 30,000,000 to 60,000,000.

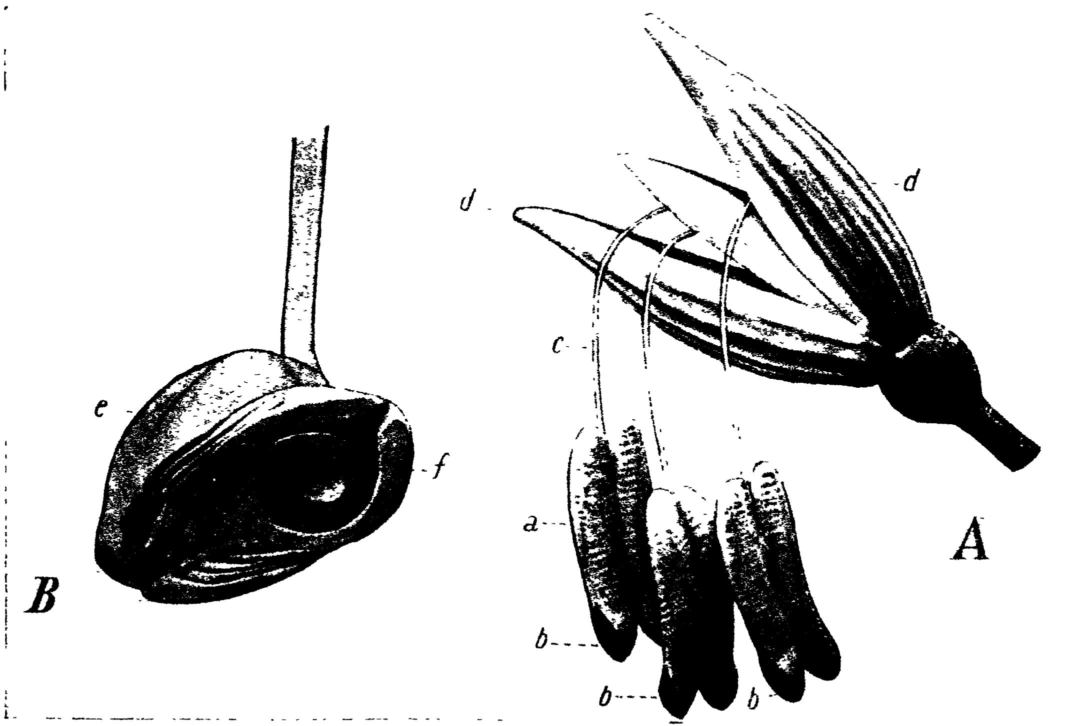


Plate 54.

Male Spikelet enlarged and Female Spikelet in section (after De Vries)

a. Anther. *b*. Pore. *c*. Filament. *d*. Glumes. *e* Section through female spikelet showing ovule (*f*).

Maize pollen retains its vitality for seven or eight days in the United States, but in the drier climate of South Africa it keeps well for three days, but after five days most of it is no longer viable.

An average ear of sugar maize produces from 250 to 350 grains of corn; Hickory King about 400; some of the more productive sorts from 1,100 to 2,800. Allowing for a production of 2,000 grains of corn requiring pollination, and a minimum of 6,000,000 grains of pollen available, we still have 3,000 grains of pollen for every grain of corn. As only one is actually required, there is abundance to spare for the bees and for waste. The amount of waste must therefore be enormous, yet we often find large numbers of ears incompletely fertilized, probably through having been receptive at a time when little pollen was available in their vicinity.

11. *The Young Ear.*—The ear is situate at the end of a much-shortened branch, the leaf sheaths of which still persist, forming the husk of the ear; often a diminutive leaf blade is developed at the end of each sheath of the husk. The ear is composed of a more or less cylindrical or tapering core, the *cob*, bearing from four to forty-eight rows of *carpels* (Plate 55).

Though the maize cob is a solid core, it is in reality made up of four or more *spikes* which have failed to keep separate during growth. Each spike bears at every joint two two-flowered spikelets, like the tassel, but the lower floret of each spikelet is abortive, leaving only a pair of *carpels* to develop at each node. This accounts for the uniformity in the development of rows in pairs.

The carpel consists of a roundish body, called the *ovary*, and a long, slender, soft thread called the *style* or "silk" (Plate 55). Each ovary contains a minute egg, called the *ovule*, which, on fertilization with the nucleus of the pollen grain, develops into a *seed*.

The cob does not complete its growth lengthwise before the first silks are ready for pollination If the growth of the plant is checked through lack of sufficient moisture or plant-food, or inclemency of the season, the tip of the ear fails to grow out, and the cob, instead of being almost cylindrical, may remain tapering in shape through lack of development. Hunt suggests that a tapering ear may, therefore, in some instances, indicate a lack of adaptation to the locality in which it was grown. In any case it is an undesirable character, as the yield of grain is lower than that of a cylindrical ear of the same length.

In "pod maize" the glumes are large, persistent, completely enclosing the ovary and persisting around the ripe grain. In the varieties usually under cultivation, however, the glumes, valve, and palea cease to function, and are reduced to small rudiments around the base of the carpel. Occasional ears are met with in a crop, in which the glumes have developed as in pod maize, but these may, perhaps, have been the result of cross-pollination.

The position of the ear varies greatly in individuals of the same variety. Some positions are more desirable than others.

12. *The Silk.*—The silk, when receptive, protrudes from the apex of the ear to receive the pollen, and may then be twelve or more inches long. After pollination the silk dries up, but persists. If pollination is prevented or is incomplete, the silk continues to grow to an unusual length, and remains green much longer than otherwise. Under a lens the silk is seen to be covered with short hairs, on which the pollen grains are caught.

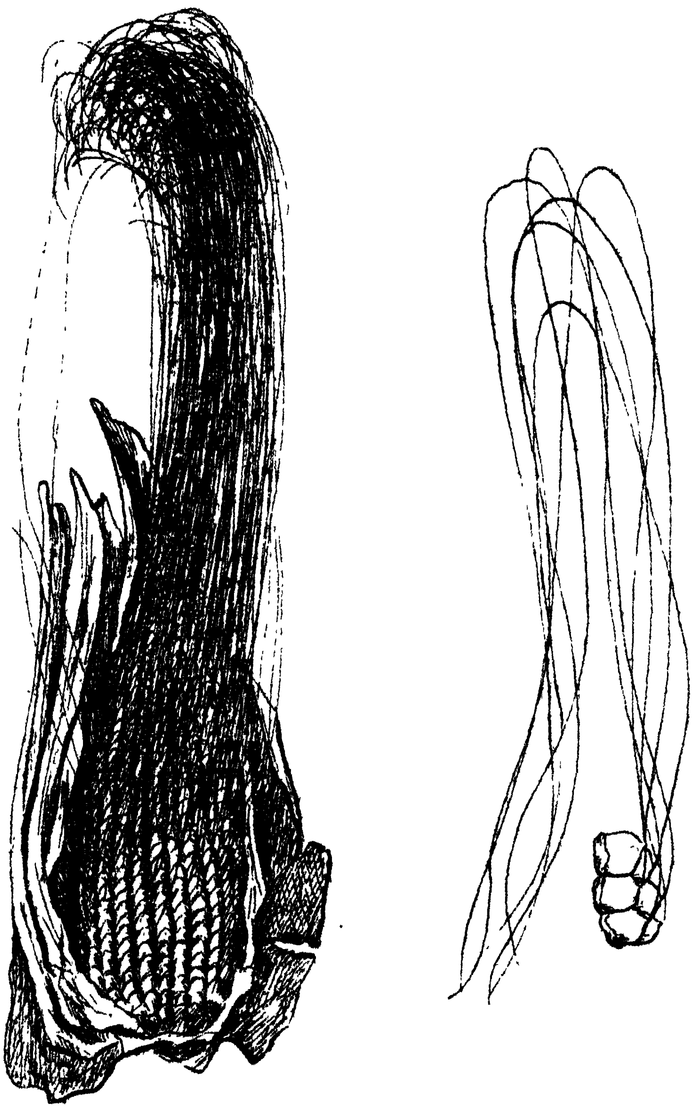


Plate 55.

Carpels, showing Ovary and Style ("Silk.")

The silks do not all mature at the same time; those at the base of the ear protrude first, then those from a little higher up, and finally those from the tip.

It takes about a week for all the silks on an ear to mature. This method of development must aid to some extent in securing complete pollination of all the ovules. It sometimes happens that there is not sufficient pollen available at the first or final appearance of the silks, but such a shortage is not likely to occur throughout the whole period of their development. (See Plate 57.)

The silk is often injured by caterpillars and by beetles, which feed upon it.

13. *Pollination and Fertilization.*—When a pollen grain is caught among the stigmatic hairs of the style (silk), it begins to grow. The pollen grain takes up moisture from the stigma and begins to swell; a tube, called the *pollen tube*, pushes out from one side, and grows along the whole length of the silk till it reaches the ovary at the base (see Plate 56*b*). Into this tube the contents of the pollen grain, including the nuclei, pass. During growth the vegetative nucleus has become gradually disorganised and lost in the protoplasm. The generative nucleus, however, has divided into two. On reaching the ovary, the pollen tube enters the embryo sac, and discharges the two nuclei; one of them enters the ovum and unites with its nucleus to form the embryo; fertilization is then accomplished. The other male nucleus fuses with the two female polar-nuclei, and these develop into the *endosperm*. The two sets of fused nuclei then begin to divide up into cells and to grow until they develop into the mature seed.

14. *Protogyny.*—According to Kerner, most monœcious plants, including the maize plant, are *protogynous*, i.e. the female flowers are receptive before the pollen of the same plant is shed, thus necessitating cross-pollination. As far as I have been able to determine, however, from observation of Transvaal fields, protogyny is not the rule here. If protogyny were complete, the very earliest plant to mature its female flowers must, in consequence, fail to propagate its kind, unless accidentally pollinated from a still earlier plant in a neighbouring field; but there must always be one plant in a district that is earliest of all, and which therefore fails to develop grain. And this habit must act to some extent as a check to any natural tendency to increased earliness in maturity.

If all the plants in a field flowered on exactly the same day, and all were completely protogynous, there would be no pollination except from other and earlier-planted fields, and those of the first planting would always fail to develop grain. But this is, of course, not the case. There is a great difference in time of flowering with individuals in the same field, due to many causes, e.g. individual characteristics, difference in depth of planting, variation in soil fertility, soil texture and soil moisture, etc. The flowering period in any one field or plot may thus extend over ten days or two weeks.

15. *Protandry.*—As previously noted, *protandry*, both complete and incomplete, is of common occurrence in the Transvaal. Protandry is the opposite of protogyny, i.e. the anthers shed all or part of their pollen before the female organs of the same plant are receptive. The very earliest pollen shed will, in such a case, be entirely wasted, unless there is a protogynous plant in the vicinity which is receptive at the same time.

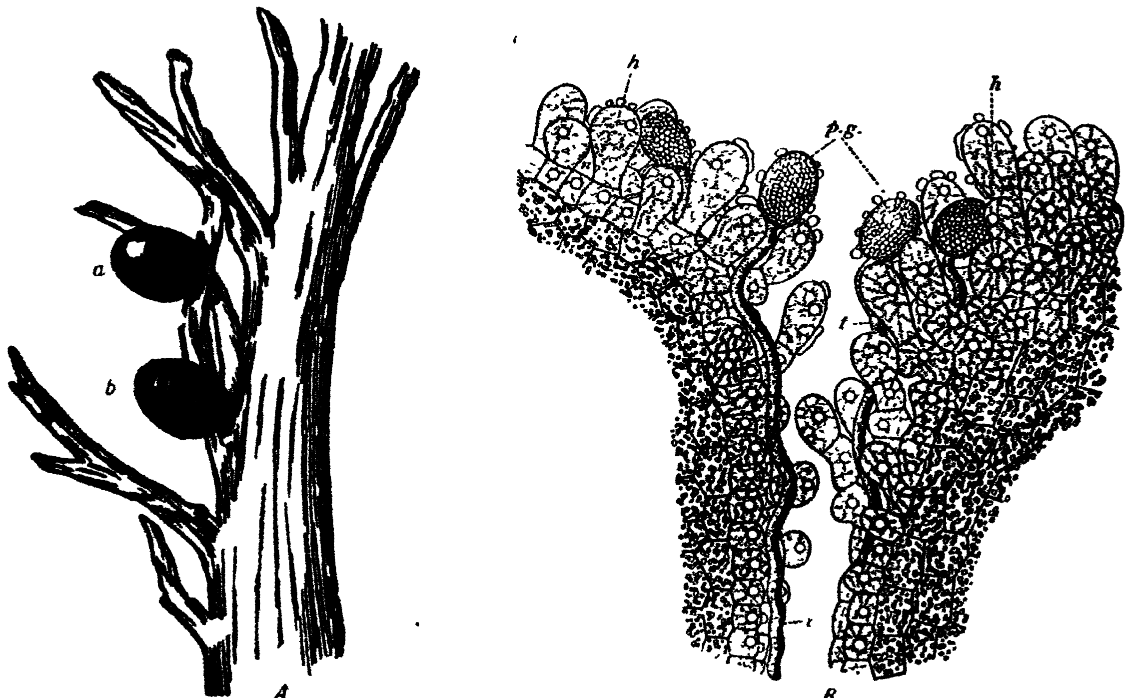


Plate 56

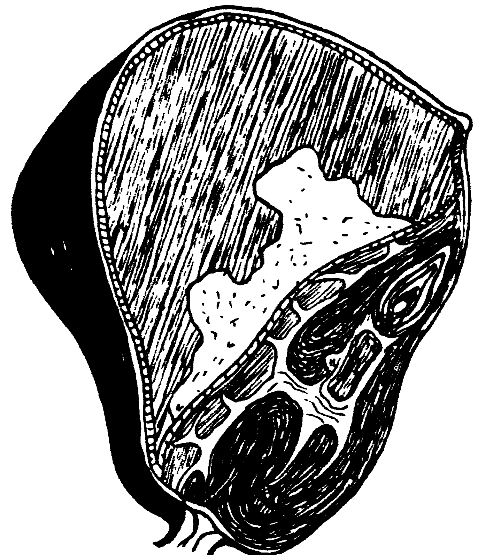
A. End of style much magnified showing pollen grains (b) adhering. B. Pollen tube (t) of a lily growing down through the style

Plate 57.

Effect of Imperfect Pollination.

Grains developed at base and apex of ear; only the glumes developed in the centre of the ear.

A



B

Plate 58.

A. Branched ear of sugar maize showing remnants of male spikelets at apex of one of the branches. Note effect of dominant character (flintness) on some grains.

B. Longitudinal section through maize grain showing relative positions of embryo and endosperm.

Plate 59.

Mixed Inflorescence of Sucker Shoot.

a Silks, *b* terminal ear bearing only female spikelets, *c* and *e* male spikelets on upper part of branch, *d* female spikelets at base of branch.

Plate 60.

Flowers of Strawberry.

Fig. 1. - Perfect. Fig. 2. Imperfect.

Observations conducted in Pretoria in the summer of 1907-08 showed that plants of sugar maize, which matured pollen on 14th December, did not have any receptive stigmas till the 16th, 17th, and even later. Where the ears were much later in developing, however, there appeared to be some check in growth, and in two or three cases very little "silk" appeared and no grain formed, even though artificial pollination was resorted to.

In some instances, however, the tassels had shed all their pollen before any silk appeared.

16. *Form for Describing the Maize Plant in the Field.*—The following is a convenient form for use in recording the vegetative characters of selected plants in the field or the breeding plot. It can be printed off on to record cards (of uniform size for subsequent filing). By marking off the character which is present, much time is saved which would otherwise be spent in writing out the cards. For instance, in (c), if the plant is in silk at the time of taking the notes, put a mark, thus √, over the word "silking," or, if it is ripe, then over the word "ripe" More space must be allowed for writing than is here indicated.

(*a*) Name of variety .... .Date of record........:..........
(*b*) Where grown. .. .. Date of planting.... ... .
(*c*) Maturity of plant: silking; roasting ear: partly dented or glazed; fully dented or glazed; nearly ripe; ripe.
(*d*) Height of stem: average of ten plants....... .feet..... .. inches.
(*e*) Stem: straight: medium; zigzag
(*f*) Stem circumference at middle of internode between second and third node from ground. . .inches.
(*g*) Stem circumference at middle of internode below main ear .. . .. inches.
(*h*) Number of ears on 100 stems. ....
(*i*) Number of barren stems in 100 plants.. .. ..
(*j*) Position of ear: in middle of stem; above the middle: below the middle.
(*k*) Direction of ear: pointing upwards; horizontal; pointing downwards.
(*l*) Length of shank: distance from node to base of ear, average of ten plants . . . .inches.
(*m*) Husks: abundant; medium; scanty.
(*n*) Husks: tight; medium; loose.
(*o*) Number of leaves: average of ten plants.. ....
(*p*) Width of leaf blades on ten plants: maximum.. .... inches; minimum...........inches; average ....inches.
(*q*) Length of leaf blades on ten plants: maximum...........inches; minimum...........inches; average...........inches.
(*r*) Length of tassel: average of ten plants.......... inches.
(*s*) Number of branches of tassel: average of ten plants..............
(*t*) Additional notes ....
....
....

17. *The Mature Ear.*—The mature ear consists of a central pithy core, called the cob, on which the grains are borne. It may vary in length from ½ inch to 16 inches, but from 4 to 9 inches is a usual range in early and medium-maturing sorts; and 9 to 14 inches in the later sorts, such as Horsetooth and Austin's Colossal.

The circumference at 2 inches from the butt should average 3 inches in an ear 4 inches long, or 7½ inches in one 10 inches long. The weight at harvest may vary from 3 to 18 ounces or more, but in time it may lose in drying from half of 1 per cent. to 35 per cent.

In shape the ear may be *cylindrical* (of uniform circumference) throughout its entire length, or more or less *tapering*.

The butt or base of the ear varies a good deal in shape and size. In a normal ear it should be of the same diameter, and have the same number of rows as the main body of the ear, but this is often not the case. If the entire end of the cob is exposed, with the butt grains at right angles to the axis of the cob, the butt is described as *even*. It may be rounded at the end and show the marks of the tightly-clasping husks on the grain, when it is called *compressed*. If there is a greater space between the rows at the butt than on the rest of the ear, it is *open*. It may be expanded by additional rows of kernels, or *enlarged* without having any extra rows.

The cavity formed by a rounded butt may be shallow and broad, moderately deep and of even diameter, or deep and of small diameter.

The apex of the ear is called the *tip*. The tip may be entirely covered with grains; it is then described as *filled*. The tip grains may be scattered or in rows, or the tip may be bare through exposure from lack of adequate covering by the husks, or from ravages of ear-worm or birds, or through drought or lack of plant-food. If a central grain projects from a filled tip it is called *capped*. In shape the tip may be rounded or flattened.

18. *The Shank* of the ear may vary in length from 1 to 9 inches or more. It may be "*large*," i.e. nearly the diameter of the cob; "*medium*," i.e. half the diameter of the cob; "*small*," i.e. one-third the diameter of the cob.

19. *The Husks* may be tight around the ear, or more or less loose and baggy, giving a deceptive appearance of size to an otherwise small or medium ear. The husks may entirely cover the ear, and even extend a long way beyond it, or they may be so short that the end or *tip* of the ear protrudes beyond them.

20. *The Cob* varies greatly in shape and circumference. If the latter is over 4½ inches it is described as "*large*"; if from 3½ to 4½ inches as "*medium*," and if 3½ inches or under as "*small*."

The cob increases in length with the growing season of the plant. It therefore remains cylindrical in shape, like the ear, if growth is retarded through lack of moisture or plant-food.

In colour, the chaffy glumes on the cob may be blood red or white. Forms intermediate in colour occur, but apparently this is the result of cross-pollination; we cannot yet say whether it is constant. As a rule, colour of cob is a fixed characteristic of a breed, e.g. in true Golden King it is always white. White-grained varieties should always have a white cob, for some of the chaffy glumes adhere to the grain in shelling, and are apt to discolour the meal. In the same way white glumes are apt to give a relatively dull shade to yellow grains when seen in bulk, and a red cob is therefore preferred for yellow maize.

21. *Number of Rows of Grain.*—The rows of grain on a cob vary in number from four to forty-eight. As a rule they range from eight to twenty in the varieties grown in South Africa. We have met with four-row ears, but these appear to be due to some abnormal condition. It is doubtful whether odd numbers of rows ever occur; if they do,

the irregularity is probably due to injury of one of the spikes of carpels during the growing stage. It often happens that a pair of rows fails to develop fully, both rows stopping short without reaching the apex. This does not appear to occur with one row alone. Sometimes one or two rows on one side of an ear fail to develop through lack of pollination, probably owing to the silks having been too crowded to develop. Ears are sometimes found in which the grains are so scattered that the number of rows cannot be traced. Sometimes this breaking up of the rows occurs throughout the whole ear, sometimes it is confined to one part of the ear. Such ears are not suitable for seed, as they tend to reproduce irregularly-shaped grains and to reduce the yield, whereas even and uniform grains pack more closely and tend to increase the yield.

Each variety has its characteristic number of rows, e.g. "Hickory King" has eight or ten (a ten-row strain is being isolated at the Government Experiment Farm, Potchefstroom); "Iowa Silver Mine" has fourteen, sixteen, or eighteen. One number of rows usually predominates in a variety, thus in "Iowa Silver Mine" it is the sixteen-row, of which there are 57 per cent., while of the fourteen-row there are only 24 per cent. It does not follow, however, that the type with the predominating number of rows is the one most suitable for propagation.

The typical number of rows may be either exceeded or increased, the whole gamut (from eight to twenty-six or more) may be found in one variety. It does not necessarily follow that an eight-row "Iowa Silver Mine" is not a true "Iowa Silver Mine," nor that a fourteen-row "Hickory King" is some other variety. But either below or above a certain number, in any one type, deterioration takes place. In "Iowa Silver Mine," for example, the ears bearing twelve, eighteen, and twenty rows respectively prove to be undesirable for propagation, entirely apart from the question of number of rows.

The proportions in which the rows occur seem to indicate that they are subject to mendelian laws. Out of eighty-nine ears of "Ladysmith White," the following figures were obtained:—

Rows.	Ears	Per cent.
14	29	32.58
16	40	44.94
18	20	22.47

With increase in number of rows there is often a corresponding decrease in breadth of the individual grains. But this is not always the case, much depending on the thickness of the cob. The grains on a sixteen-row ear are sometimes broader than those on a twelve-row ear of the same variety, if the cob of the former is thick while that of the latter is thin.

It does not always follow that increase in number of rows of grain on the ear is accompanied by increase in amount of grain produced. In "Golden King," the best fourteen-row ears gave more grain than the best twelve-row, but some of the ten-row also gave more than the twelve-row. In Natal Yellow Horsetooth (dent), the ten best fourteen-row ears also gave more grain than the corresponding twelve-row ears, but the ten poorest ears of the latter gave more than the ten poorest fourteen-row ears. In Yellow Hogan, the seven best fourteen-row ears gave more grain than the seven best sixteen-row ears.

The same number of rows does not give equally good returns in all varieties alike. Each breed seems to have a normal number of rows, which gives the best results in weight, shape, and size of grain, above or below which deterioration commences. It will require further study to determine with certainty what is the optimum number of rows for each breed grown in South Africa.

22. *Twisted Rows.*—The occurrence of a twist in the rows, either to left or right, is a common feature. It is often confined to the upper portion of the ear, but may start from near the base. It is an undesirable feature, as it tends to the development of irregular grains. This twisting appears to be in some way associated with the development of the number of rows. Out of a number of cases examined, the following figures were obtained:—

Rows.	Left Twist.	Per Cent.	Right Twist.	Per Cent.	Total.
14	17	58·62	12	41·38	29
18	12	60·00	8	40·00	20
	29	Av. 59·31	20	Av. 40·69	49

16 Rows very straight, no twist.

23. *Number of Grains per Ear.*—The number of grains per row varies to some extent with soil, seasonal rainfall, etc.; but, apart from this, there appears to be a definite relation between the number of grains and the variety. Hickory King in the Transvaal ranges from about 350 to 400: Austin's Colossal runs up to 1,100. Burton reports a case in Aliwal North Division of an ear bearing 2,828 grains. This was one of eight ears from the same plant (breed not stated).

24. *Proportion of Grain to Ear.*—Where maize is sold *on the cob* for feeding to stock or for seed, as is often the case in the United States, the amount of grain which can be obtained from a bushel or muid of ears is of great importance. As the proportion varies, so will the price fluctuate.

The proportion of grain to ear is exceedingly variable, not alone as between varieties and under different conditions of growth, but also in the same variety grown under similar conditions. In America it is stated that 86 to 87 per cent. of grain per ear may be considered a fair proportion. In Transvaal-grown samples examined last year, the percentage was usually much lower, averaging only 82.13 per cent.

However, there does not appear to be any connection between *high yield* of grain per ear and percentage of grain on the ear. The heaviest yielding variety of those studied (Natal White Horsetooth) gives the lowest percentage of grain, while the one giving the highest

percentage of grain gives a relatively low yield. But it does not follow that the variety giving the highest percentage of grain gives actually the lowest yield.

American growers lay much stress on high percentage of grain to ear, because a great deal of maize is there sold on the cob, and buyers prefer strains which, when shelled, will bag up well. The growers admit, however, that percentage is of lesser importance than actual yield. In South Africa, where maize is sold entirely off the cob, the question of percentage does not appear to be of great importance.

25. *Form for Describing the Ear.*—The following is a useful form for recording the characters of typical ears in order to determine from year to year whether any change is taking place or whether they are remaining true to type. Owing to the difficulty of keeping specimen ears for any length of time, a written record is desirable. For definition of terms, see preceding paragraphs under each head.

This form can also be used to advantage by students in agriculture. In this case each student should have two or more ears of each of the five varieties of maize, or of five different breeds of the same variety. Ten ears of a given variety or breed are none too many for a thorough study. Ears of other varieties or breeds, showing the characters here mentioned, should be shown for the guidance of students.

The character present may be marked by a √ across the word.

Name: Variety........................ .. . Breed..............................

Date of: (*a*) Record......... (*b*) Sowing......... (*c*) Harvest.........

(*a*) Colour of grain: white; yellow; golden: red; purple; blue; or black.

(*b*) Colour of cob: white; light red; deep red.

(*c*) Surface: smooth; medium; rough; very rough.

(*d*) Sulci: absent; apparent; narrow; distinct; very distinct.

(*e*) Pairs of rows: distichous; not distichous.

(*f*) Number of rows: at ½ length from butt.........; from tip.........

(*g*) Direction of rows: straight; right twist: left twist; irregular.

(*h*) Grains: very loose; loose; firm.

(*i*) Grains: regular; mosaic-like; uneven.

(*j*) Grains: upright; sloping; imbricated.

(*k*) Ear: cylindrical; cylindraceous; slowly tapering; tapering.

(*l*) Butt: even; shallow rounded: moderately rounded; deeply rounded.

(*m*) Butt: depressed; compressed; depressed-rounded; depressed-compressed; enlarged; expanded: open.

(*n*) Tip: sides of cob exposed; end exposed; end covered; terminal grain.

(*o*) Juncture of shank with ear: large; medium; small.

(*p*) Extreme length of ear: maximum...........inches: minimum; ....inches; average of ten...........inches.

(*q*) Circumference of ear at 2 inches from butt: maximum........... inches; minimum...........inches; average of ten...........inches.

(*r*) Circumference of ear at 2 inches from tip: maximum........... inches: minimum...........inches; average of ten...........inches.

(*s*) Weight of ear: maximum...........ozs.; minimum...........ozs.; average of ten...........ozs.
(*t*) Weight of cob: maximum...........ozs.; minimum...........ozs.; average of ten...........ozs.
(*u*) Percentage of grain: maximum...........; minimum...........; average of ten...........
(*v*) Circumference of cob at 2 inches from butt...........inches.
(*w*) Ratio of circumference of cob to that of ear...............

26. *The Grain or Caryopsis.*—The grain of maize and other grasses is often spoken of as a *seed*, but it is in reality more than a seed; it is a whole *fruit*. It is a peculiar form of fruit, for the *seed-coat* is completely united with the pericarp or outer covering of the fruit. This special form of fruit is distinguished by the name of *caryopsis.*

The caryopsis of the maize-plant consists of the *hull*, which is the combined pericarp and seed-coat. Lying immediately under the hull is a layer of cells known as the *aleurone layer* (29).

The hull and aleurone layer together enclose the main mass of the grain. This consists of two distinct parts, the endosperm (30) and the embryo (27).

The grain may be firm on the cob or movable. This may, perhaps, be due to the ear being not fully mature when gathered, or to lack of adequate moisture at the time of ripening off.

Its position may vary between right angles to the surface of the cob and sloping towards the tip.

The shape varies greatly. In most varieties it is flattened and more or less wedge-shaped, with an indented apex (Dent maize); in one variety it is spheroidal or conical (Flint maize). In sugar maize, when dry, the grain is much wrinkled.

Depth.

The depth of the grain varies greatly, and is said to be a quite constant character in different breeds. Breadth and thickness of grain, on the other hand, are not considered as being so constant.

Shape.

(*a*) If broad above, tapering to a slender base with straight sides, it is described as *straight cuneate.*

(*b*) If the same general shape, but with rounded edges, it is *curved cuneate.*

(*c*) Broad above, narrower below, connected by straight lines, *truncate cuneate.*

(*d*) Long and uniformly narrow above, only tapering to a more or less broad base, *shoepeg form.*

(*e*) Short, and as broad at base as summit, *rectangular.*

(*f*) Slightly rounded at corners, both above and below, *round-cornered.*

Apex.

(*a*) *Roof-shaped* at one edge, i.e. convex at one and flat at the other.

(*b*) *Shingled,* i.e. overlapping like shingles on a roof.

(*c*) *Flat* or *square,* corners not rounded at summit.

(*d*) *Rounded*, corners rounded at summit.
(*e*) *Rostrate* or *beaked*, with long, sharp, tapering projection.
(*f*) *Mucronate* or *pointed*, with small, sharp point at summit from embryo side.
(*g*) *Dented* (only in Dent breeds), with an indentation of varying size and form.

Indentation.

(*a*) *Round*, dimple rounded or cup-shaped and quite smooth.
(*b*) *Long*, dimple dented and quite smooth, i.e. longer than broad.
(*c*) *Creased*, i.e. edges pressed toward each other, leaving a small space between, and the edges parallel.
(*d*) *Pinched*, the edges pinched closely together and projecting upward and forward.
(*e*) *Rough*, with any rough, jagged, or beaked projection from the summit.
(*f*) *Bridged*, with a fold across the centre.
(*g*) *Crumpled* or wrinkled, as in sweet maize.

Each of the five cultural varieties of maize (Pop, Flint, Dent, Flour, and Sugar) contains three well-defined sub-types, based on the relative breadth and depth of the grain. Thus:

Group A.—Grain broader than deep.
Group B.—Grain as broad as deep.
Group C.—Grain much deeper than broad.

According to Sturtevant, these depend on climatic conditions; the A group growing in short-season climates, the C group in long-season climates, while the B group is intermediate. A climate suitable for the C group will, naturally, also suit the other two groups, but they may not prove as profitable, and would therefore be less desirable.

27. *The Embryo.*—The embryo (Plate 58 *B*) is the vital part of a seed. As the word implies, it is a living, though dormant, plant in embryo, all the essential organs of growth, root, stem, and leaves being present. It is carefully wrapped up and protected from the weather, first by the testa or seed coat, and in addition by the pericarp or envelope of the fruit, which in many kinds of plants encloses more than one seed, but in the maize and other grasses only one. The embryo plant is also furnished with a store of elaborated food, from which it can draw nourishment for the increase of the root, stem, and leaf, until such time as the root is able to draw water and food-substances from the soil, and the leaf to elaborate them into available food.

In some plants, e.g. the castor-bean and the lucerne, this reserve store of food material is deposited within the seed leaves themselves; these are known as *cotyledons*. But in maize and other grasses, and many other groups of plants, it is deposited quite outside and partly surrounding the embryo. It is then known as the *endosperm* of the seed (Plate 58 *B*). The growing embryo absorbs the endosperm through a special organ, the *scutellum* or shield, which in the maize grain can be readily seen with a low-power microscope.

The embryo of the maize grain is not completely surrounded by the endosperm, but lies at one side of it. As the grain stands on the ear, it is on the upper side of the grain, i.e. towards the tip of the ear.

It is relatively large in size, composing from 7.7 per cent. to 15.7 per cent. of the grain. In an average ear about 12.5 per cent. is embryo.

The average chemical composition of the water-free embryo is reported to be about as follows:—

Fat ...	...	55.1 per cent.
Protein	...	29.7 per cent.
Ash ...	...	15.1 per cent.

28. *The Hull.*—The *hull* or outer covering of the ripe maize grain is hard and shiny. It comprises the *pericarp* of the fruit together with the *testa* or seed-coat (with which it is united) and the perisperm, a layer of tissue beneath the testa and surrounding the endosperm Of these three tissues the pericarp forms the larger part of the hull of the ripened grain. Including the point at the base of the grain, the hull has been found to constitute about 7 per cent. of the grain of Dent maize.

The hull can easily be removed from the aleurone layer for study by soaking in hot water for about fifteen minutes.

29. *The Aleurone Layer.*—Lying immediately beneath the hull, between the perisperm and endosperm, is a tissue composed of a single row of comparatively large cells, rather regular and rectangular in transverse or cross section. This tissue is called the aleurone layer: it comprises from 8 per cent. to 14 per cent. of the grain. Webber has shown that the blue, purple, and black colour of the soft flour and sugar varieties of maize lies in the aleurone layer.

Hunt notes that this tissue contains a slightly greater percentage of protein, considerably greater percentage of carbohydrates, and a much lower percentage of ash and fat than the embryo.

30. *The Edosperm.*—This is the tissue lying below the aleurone layer, but above and partly surrounding the embryo. It comprises about 73 per cent. of the whole grain. Its function is that of a reserve store of elaborated plant-food for the use of the young seed plant before it is able to absorb food materials from the soil or to elaborate them in the leaf. Hopkins finds that the endosperm is composed, on the average, approximately as follows:—

Carbohydrates, 89 to 93 per cent.
Protein, 10 to 6 per cent.
Fat, less than half of 1 per cent.
Ash, less than half of 1 per cent.

As seen in section, the endosperm shows a variation from trans lucence to opaque snowy whiteness. Hopkins reports a difference of 2 per cent. more protein in the corneous than in the white endosperm, but Hunt questions whether this may not be due to lack of complete separation from the aleurone layer. The latter author points out that there is no material difference in structure noticeable under the microscope, which has led to the suggestion, not positively proven, that the difference is a difference in density analogous to the difference between snow and ice.

The relative proportion and arrangement of the translucent or corneous and the white endosperm have been used in part to differentiate between the five varieties of maize.

31. *Form for Describing the Grain.*—This may be used to advantage for the same purposes, and in the same manner, as the form for describing the ear.

For the use of students in agricultural botany, twenty-five to thirty grains should be given of each of the five varieties, or of five breeds of one variety. For determining the points in Nos. 12 to 18

inclusive, a number of grains should be soaked in hot water for thirty minutes, or in cold water for twenty-four hours. For measuring the grains, a sheet of cross-ruled paper can be used to advantage for marking off distances, which can then be measured accurately by a scale divided to 32nds of an inch, or preferably to millimetres.

Name: Variety............................; breed..........................

Date of (*a*) record.........; (*b*) sowing.........; (*c*) harvest.........

(*a*) Weight: ten average grains in duplicate (*a*)......... (*b*).........

(*b*) Length: ten average grains in duplicate (*a*)......... (*b*).........

(*c*) Width: ten average grains in duplicate (*a*)......... (*b*).........

(*d*) Thickness: ten average grains in duplicate (*a*)......... (*b*).........

(*e*) Ratio of width to length: divide length of ten grains by width of ten grains (*a*)......... (*b*).........

(*f*) Ratio of thickness to width: divide width of ten grains by thickness of ten grains (*a*)......... (*b*).........

(*g*) Shape: flat; spheroidal; conical.

(*h*) Shape (side view): straight cuneate; rounded cuneate; curved cuneate; truncate cuneate; shoepeg; rectangular; round cornered.

(*i*) Apex: roof-shaped; shingled; rostrate; mucronate; rounded; flat; dented.

(*j*) Indentation: round dimple; long dimple; creased; pinched; rough; bridged; wrinkled.

(*k*) Colour: white; cream; yellow; golden; red; blue; purple; black; striped; mottled; mosaic.

(*l*) Place of colour: endosperm; aleurone layer; hull.

(*m*) Character of endosperm: corneous; partly corneous; farinaceous; sugary.

(*n*) Proportion of corneous endosperm (in Dent variety): large; medium; small.

(*o*) Embryo size: large; medium; small.

(*p*) Sketch of longitudinal cross-section: show arrangement to scale of embryo, and of glossy and white endosperm.

Cost of Production of Maize in the Standerton District.

By Bruce Hutchinson.

(Of Hutchinson & Shaw, Zandbaken, Val Station.)

The following memorandum has been prepared in order to supply certain data desired by the Department of Agriculture. On an average yield of seven muids of maize per acre, we consider it costs us 3s. 8d. per muid to deliver f.o.r. at Val Station.

The actual cost of ox labour is rather hard to get at. I have taken it on the basis that an ox does not cost more than 20s. per year to keep; as our oxen work quite 240 days out of the year, this works out at a penny per head per day. When we want oxen we usually buy young ones at £7 10s. to £8 per head, and when they have worked for six or eight years we fatten them up and sell for slaughter; they are then worth from £10 to £14, according to size, so that there is no depreciation on oxen, but still some allowance must be made for expense of feeding them in the winter. Twenty shillings per head per year, I think, is a very fair allowance for this.

With regard to cost of labour, any number of natives can now be got for 40s. per month of thirty working days, and their food, which does not amount to more than 5s. per month—45s., or 1s. 6d. per day.

Depreciation of implements is rather difficult to estimate accurately. I have based this on our experience of how long the various implements last, and what they cost us for repair.

The day's work is in every case put very low. For ploughing we always reckon four acres a fair day's work, and sometimes do five; harrowing, we usually do twelve to fifteen acres per day, and scuffling five to six acres; planting sixteen to eighteen acres. These figures are what we actually do for a full day's work. But, of course, there are occasional wet days and breakages of implements which waste time, so one must put the average day's work low to get a fair estimate of cost.

In reaping, the cost of carrying off is put rather high. Most of our fields are some distance from the homestead, where we take all our maize ears for convenience in shelling. I have no doubt some growers who do not carry so far could reduce this nearly a half.

The average yield of seven muids per acre is, I think, a moderate estimate for this district. Of course this only refers to the growers who really farm in a proper way. When the land is badly ploughed, the maize broad-casted, and little or no after-cultivation given, I do not know what the yield is, probably not more than three or four muids per acre.

One of our neighbours who has had maize on the same land (over 100 acres) for six years now, reaped over ten muids per acre for four years running; last year he got barely nine muids per acre, but last year was a very bad year indeed for maize. This season, being the sixth year, his crop looks very well indeed, and promises to go over ten muids per acre again.

When growing maize on fertilized land, that is, after a crop of potatoes, the returns are much higher. Year before last (1906-07) on land that

had been fertilized for potatoes the previous season, we reaped from forty-eight acres sixteen and a half muids per acre, and from twenty acres seventeen and a half muids per acre. As to how long the residual value of fertilizer lasts in the land we have hardly enough experience to speak definitely. But the difference is distinctly noticeable for three seasons.

I think it would be a very reasonable estimate to reckon on fourteen muids per acre the first year after potatoes—provided, of course, that they had been well fertilized with not less than 600 lbs. per acre of some good fertilizer—running down to ten or eleven muids per acre the third year. As to whether it will pay to fertilize direct for the maize crop, that has still to be proved.

But without fertilizing at all, given reasonable cultivation, there is no doubt that maize-growing is a paying branch of farming in this district. The quantity that could be produced would be enormous, if only a reasonable proportion of the available land were cultivated. Unfortunately, as it is, only an infinitesimal portion of the land is under cultivation, and a great deal of what is cultivated is done very badly.

STATEMENT OF COST OF GROWING MAIZE.

	s.	d.	
Depreciation of Plough per acre :—	s.	d.	
Shares	0	4	
Plough	1	4	
Gear	0	4	
Total	2	0	
Ploughing per Day—three-furrow plough, three acres per day :—	s.	d.	
14 oxen	1	2	
2 boys at 1s. 6d	3	0	
Three acres =	4	2	
Actual Expenses	1	4⅔	per acre.
Depreciation as before	2	0	
Cost per acre	3	4⅔	
Say	3	6	per acre.
Harrowing per Day, 10 acres :—	s.	d.	
6 oxen	0	6	
2 boys at 1s. 6d....	3	0	
Depreciation	2	6	
10 acres =	6	0	
1 acre =	0	7⅕	
Say	0	7	per acre.
***Planting per day*, 16 *acres (two double-row planters coupled together)* :—**	s.	d.	
6 oxen	0	6	
2 boys at 1s. 6d....	3	0	
Depreciation	4	6	
16 acres =	8	0	
	0	6	per acre.

Scuffling per day, four acres :—

		s.	d.
2 oxen ...	... ...	0	2
2 boys at 1s. 6d. ...	... ...	3	0
Depreciation	... ...	0	4
	4 acres =	3	6
		0	10¼
	Say	0	10 per acre

Cost of Preparation, Planting, and Cultivation, per acre :—

		s.	d.
Ploughing	... ...	3	6
Planting	... ...	0	6
3 harrowings at 7d.	... ...	1	9
3 scufflings at 10d.	... ...	2	6
Seed - 1 bag to 18 acres	... ...	1	0
Rent ...	... ...	0	6
Fencing (in 100-acre blocks, interest on capital at 10 per cent.)	... ...	1	6
Sundries	.. ..	1	0
	Average crop 7 muids =	12	3
	Cost of growing per muid =	1	9

		s.	d.
Reaping per muid	... ...	0	2½
Collecting and carrying off the field at 1s.	... ...	0	4½
Shelling	... ...	0	6
Sack ...	.. ..	0	7
	Reaping, shelling, etc. =	1	8
	Growing	1	9
		3	5
	Delivery to station ...	0	3
	Total	3	8 per muid f.o.r.

The Strawberry.

By R. A. Davis, Horticulturist..

It is only within the past few years that the cultivation of this most delicious of all berry fruits has made any headway in the Transvaal. Such a thing as a five-acre field of strawberries was unknown, and, it may be added, is exceedingly hard to find to-day. The writer knows only one such in the Colony, and it is quite certain that the luscious berry is grown on altogether too small a scale.

True, there are a few small patches of from half an acre up to an acre and a half or two acres, but planting on such a scale is wholly inadequate to the needs of such a town as Johannesburg, and it is quite certain that a large proportion of our population goes through the year without even seeing a strawberry. Why this should be the case it is hard to say. There are very few spots in the Transvaal where the strawberry cannot be grown, and grown well, and these are practically all in the low veld. Even there one can find an occasional spot where the plant will grow and fruit successfully. Not very long ago it was stated that Pretoria was unsuitable for this crop; the heat was too great, etc.

That idea no longer exists, and it may be interesting to state that a crop on the scale of one and a half tons per acre has been grown near the railway station by Mr. Waddell. Now this gentleman is an old hand at the work, and he sets out his plants in the right way; gives them room enough to breathe and water enough when they are thirsty; he follows lines which lead to success, and looks after everything at the right time and in the right manner. It is with the idea in view that others might care to benefit by the result of experience that the present article is being written.

Before commencing to speak about approved cultural methods the writer desires to draw attention to the following clipping from an English newspaper, which will give some idea as to the scale on which strawberries are being grown there. In the culture of this particular fruit it is certain that England is not far from being in the front rank, no matter what opinions may be held with regard to her achievements in other directions in the fruit world. Varieties originated there have been frequently imported to South Africa, and have proved to be, on the whole, well suited to this sub-continent, notwithstanding the wide differences of climate to which they have been exposed.

From the London *Times*:—

"THE STRAWBERRY HARVEST, 1908.

"Statistics just compiled in respect of the strawberry harvest, which has now practically closed, show that the present has been one of the most prolific seasons enjoyed by British cultivators for ten years at least. The total harvest for Britain exceeded 60,000 tons—a gigantic output—possibly the largest known. The total value of the crop exceeded a million and a half sterling. Of this immense sum the bulk was paid to English growers, despite the advances made during recent years in the strawberry districts of Wales, Scotland, and

Ireland. The fruits from the Hampshire farms, being available for market very early in the season, commanded excellent prices for many tons of berries, and these high prices did much to force up the general average value. One Kentish strawberry farmer, with over 300 acres under cultivation, was enabled to distribute over 600 tons of berries, in peck baskets, alone. In respect to size, there can be no doubt that the Kentish fruit took the lead. Some of the specimens from Orpington measured seven and eight inches in circumference. These wedge-shaped fruits are immensely popular, and command a ready sale at good prices. As the result of the remarkably fine season enjoyed by fruit farmers, strawberry planting will receive a great impetus during the coming year. Already preparations are being made in several Kentish districts to plant runners in August to assure a good crop during 1909. One plant distributor near Maidstone has booked one order for 100,000 runner plants."

Soil.

Any good vegetable soil will grow strawberries, but the best results may be expected from one which is light and loamy rather than a dark, heavy, or turfy soil.

For a business proposition one must look for the best possible conditions, and these are certainly obtained on the lighter class of loams. Good red soil of this nature, even with an admixture of gravel, is also suitable, and will grow a good class berry of much better colour than can be produced on heavy land.

It is well to see that in preparing for planting, arrangements are made to admit of irrigation, for without plenty of water the growing of strawberries in South Africa is out of the question. This remark applies both to culture on a large and small scale. In the latter case, as in gardens for instance, water is usually procurable, but for field culture one has not only to see that water is available, but to so prepare the land by grading and levelling, where necessary, that it may reach the end of the longest row without difficulty. Unless the soil is rich, manuring must be at once resorted to, and for this purpose ordinary stable manure may be used in liberal quantities, the addition of a little muriate of potash—say two sacks per acre—will be found to pay, as it materially helps the size of the fruit.

The deeper the land is ploughed or dug the better, but after this operation is completed it is necessary to bring the top soil into as fine a condition of tilth as possible, so as to have a mulch of at least a couple of inches of fine loose ground on the surface. All this work must of necessity be completed before planting time.

Time for Planting.

There are two seasons for this, July and January, or thereabouts; if July planting is adopted a small crop may be looked for the following summer; if January planting is undertaken, and the plants make good headway through the summer rains, berries may be expected in the following spring in fair numbers.

By far the larger proportion of planting is done in July, and this month appears to be the favourite, notwithstanding that more work is entailed in watering the young plants.

Distance of Planting.

This depends to a certain extent on the varieties grown. Some sorts are naturally inclined to a vigorous growth of runners, and for these a greater distance must be allowed. Garden cultivation usually demands as many plants as possible in a comparatively limited space, and for such one may say that the closest planting to give good results should not be less than in rows 12 inches apart and 8 inches apart in the rows. In growing on a larger scale a more liberal allowance of land is necessary, and the minimum distance should be rows 18 inches apart, with plants 12 inches apart in the rows.

This is only possible when hand cultivation is used, but this distance, even with the additional expense of this kind of culture, has been found to yield better returns than any other.

When a five-acre patch is contemplated the land must be tilled by horse or mule and small cultivator, and this necessitates rows at least 30 inches apart, with plants at from 12 to 15 inches distant in the rows.

As has been stated, irrigation is imperative, consequently frequent cultivation is also needed, but this must be of a very shallow nature, as the strawberry strongly obects to any interference with its roots.

Propagation.

This is of the simplest nature, as nearly all plants reproduce themselves freely by "runners," but because it is so easy it does not follow that it should be carelessly done. Plants which are to bear heavily should not be allowed to have any runners except those necessary for reproduction, say one or two, and these only after the main crop is harvested. If plants grow runners they must not be expected to bear much fruit; on the other hand, many nurserymen grow plants for the sake of the runners. In cases of this kind fruit is a secondary consideration, but it should be borne in mind that for this purpose good rich soil is required if the strongest and best class of plants are to be obtained. Complaints have been frequently made to the writer, of strawberry plants not bearing; they may look healthy in every way and blossom freely, yet no fruit is matured. In most cases this is due to "imperfect flowers," that is flowers which are only "pistillate," and without stamens. If pistillate kinds are grown they must be interspersed freely with rows of varieties with "perfect" flowers, i.e. with both stamen and pistil; in other words, male and female. The best method, of course, is to plant only those varieties which are known to bear perfect flowers, and as this cannot be seen from the appearance of the plants when not in bloom, one is largely in the hands of the nurseryman from whom the plants are purchased.

Perfect and imperfect blossoms are shown in the illustration (Plate 60). Nos. 1, 2, and 3 being perfect, and Nos. 4 and 5 imperfect.

Varieties to Plant.

As far as reliable reports go, good results have been obtained from the following varieties:—

Laxton.	Reine Hâtive.
Laxton's Royal Sovereign.	The Czar.
Marguerite.	Monarch.
British Queen.	Cape.

As far as the Cape berry is concerned the correct name of this fruit cannot be traced, but it is a good and vigorous grower and bearer of medium-quality fruit, and is extensively cultivated in Cape Colony.

In addition to the above, many other varieties are under test at the various experiment stations of the Division of Horticulture, and particulars with regard to their suitability for cultivation in the Transvaal will be published as soon as sufficient time has elapsed for a correct opinion to be arrived at.

Setting Out.

In setting out the young plants there are, of course, two ways of doing it, one right and the other wrong. The right way is to plant in a shallow hole slightly raised in the centre, care being taken to spread out the roots in their natural direction, filling in with fine soil, and making the whole firm afterwards. The wrong way is to set the roots in a hole made with a stick or a spade, ramming them in without any effort being made to disentangle them; such planting is really not planting at all, and the results are bound to be unsatisfactory.

Water at planting should be freely used, but neither at this stage nor at any other in the life of the plant is it necessary to sprinkle them. Water should be led in furrows near the plants, and not sprinkled over them. In addition to rendering the plants more susceptible to such troubles as strawberry leaf-spot, the fruit is liable to be splashed with mud, thus rending it unsightly and perhaps unsaleable.

This leads to the question of mulching the plantation with straw or long grass. Undoubtedly the use of either of these is good, as it keeps the berries away from the ground and clean, even after a heavy rainstorm. Against the use of the mulch may be argued its danger as a harbour for insect pests, slugs, etc. Points such as these must be left to the initiative of each individual grower.

The life of a strawberry bed is, in some countries, but a short one, it being found that the plants are most profitable during the first year. Such is not the case here, as experience has shown that the second year's returns are the best, whilst a third year's term is often amply justified. After that it is advisable to root out the old plants. The bed, if to be used again at once, should be thoroughly fertilized and dug over as deeply as possible.

New Varieties.

So far nothing has been done in this Colony in the way of producing new varieties. It is to be hoped, however, now that more interest is being taken in this fruit, that this will be done. Reproduction by runners perpetuates only the variety from which they have been taken.

In order to produce something new it is, as a rule, only necessary to plant the seed of the berries, and this is a most interesting study, as it is impossible to foresee what the resulting plants may produce.

Naturally one would plant seed only of some well-developed, vigorous, and desirable fruiting variety, hoping for a perpetuation of the type in certain particulars at least.

Where the originating of new varieties is carried out on a large scale, it is customary to cross such as possess the most desirable qualities, and such considerations as health and constitution of the parents are studied; also time of ripening, shape, size, and flavour of fruit, resistance to disease, etc. An occasional reverting to some wild type is also resorted to for the purposes of crossing, but so far as the writer is aware this would be out of the question in this Colony owing to their absence.

It is a well-known fact that seedlings from an imported variety are often more successful than the original, owing to more perfect acclimatization, accustomedness to their surroundings, and various other causes, and it is suggested that much valuable work may be done in this line. Who is going to originate the first Transvaal variety of strawberry?

Construction of Modern Silos.

By A. Morrison Hay.

Silos, or chambers for the storage and preservation of food, have been in use in one form or other in various countries from very early times. In France and Spain, and other parts of Europe, grain was preserved in trenches, dug in the ground, at the time of Pliny, who mentions in certain of his writings that "the best plan of preserving grain is to lay it up in trenches dug in a dry soil, called siri, as they do in Cappadocia, Thracia, Spain, and in Africa." This method of preserving grain was not confined to the East, as at the time of the discovery of America by Columbus the natives were in the habit of storing grain in pits, and certain tribes continue the practice to the present time. The ancient Egyptians, as we learn from Scripture, stored sufficient grain in the seven years of plenty to serve themselves and other nations during the seven years of famine that followed. The Egyptian silos were evidently of a more improved and permanent nature than the rude trenches above referred to, as Wilkinson in his work, "The Ancient Egyptians," states that "some of the rooms in which they housed the grain appear to have had vaulted roofs. These were filled through an aperture near the top, to which the men ascended by steps, and the grain, when wanted, was taken out from a door at the base."

It is important to note that the early silos were used principally for the preservation of corn and other dried cereals, for indefinite periods, such as from years of plenty to years of scarcity, and there are instances of corn having been preserved in good condition for the long period of 200 years. On the other hand, the silos of the present day are used more particularly for the storage of green fodder, to provide food for cattle during the winter months, or for a year at most. Food thus preserved may, however, be kept indefinitely provided that air is not allowed to enter the silo. For this reason it is important that the sides and floor should be perfectly air-tight, and it is also essential that the sides be smooth and vertical, so that the silage may settle uniformly and compactly, leaving no vacant spaces for the accumulation of air.

Silage is the name given to any green and succulent food preserved in a silo, either in an uncut form or after being passed through a cutting machine and reduced to small pieces. After it is filled into the silo fermentation commences, which increases the temperature and expels the air. Thereafter, chemical change ceases, and the resulting product is a sweet silage which may be preserved indefinitely, provided air is not allowed to penetrate the mass. The temperature required to produce this result is about 122° F., and if, from any cause such as an excess of moisture in the plant, or excessive cold, the temperature does not attain this height, the acid ferments will not be destroyed, and the resulting product is a sour silage, less palatable and less valuable than the other. During the process of fermentation gases are generated to a considerable extent, and the top of the silo should be sufficiently open to allow these to escape. After the silo is filled the air may be prevented from entering the silage to any great depth by covering it with any less valuable material, or with sailcloth. Another method which is both cheap and efficient is to sow some grain, such as oats, on the top of the silage, and pour water over it.

The word "silo," taken from the Greek "siros"—a pit for holding grain—is the name now applied to any air-tight chamber formed for the preservation either of dried grain or green food. It may be simply a trench or pit dug in the ground in any dry position, into which the silage is filled and weighted down with planks, earth, or other material. More commonly it is a structure of wood, metal, brick, stone, or other building material, or a combination of these, built entirely above ground or extending down only a few feet, and standing either by itself or forming a part of the other farm buildings. The origin of structural silos on the modern plan is of very recent date, but the progress of siloing has been so rapid and successful—in America, at any rate—that in the short period of thirty years over a hundred thousand silos have been built in the United States alone, and the number is steadily increasing.

In form the silo may be built either square, rectangular, octagonal, or circular on plan. If forming part of a scheme of buildings its shape would probably be decided by the position it occupied and the space available, but if standing alone either form could be adopted at will. The round silo is more favourable to the even and compact settling of the silage owing to the absence of corners, and, consequently, more favourable to its perfect preservation. On the other hand, it does not fit in with other buildings so readily as a square or rectangular silo, without loss of space, and for this reason the latter are likely to be more frequently built. The same remarks would also apply to octagonal silos. If standing alone, however, no objection can be raised either to the round or the octagonal form of silo, and as the proper preservation of the silage is the main object to be attained, one or other of these forms should be adopted in preference to the others. The main objection to square or rectangular silos is the presence of corners, which prevent the silage from settling uniformly and compactly, thus causing waste of space and creating undesirable accumulations of air. This defect may be remedied to a considerable extent by having the corners well rounded. Of the two, the square silo is perhaps the better form, and probably somewhat cheaper than a rectangular one of equal capacity, as the wall space is rather less. For round silo see Plate 61.

Where a large quantity of silage is required it is advisable to have it stored in two or more moderately-sized silos in preference to one very large one. With very large silos too much surface of silage is exposed while feeding; and, if the height is increased to modify the surface dimensions beyond a reasonable limit, excessive labour is involved in the working. The height above ground should not exceed 20 to 25 feet, and the depth under ground should not be more than 5 or 6 feet, the limit from which a man can conveniently lift the forage. With rectangular silos the difficulty can be obviated by having one or more partitions dividing the silo into two or more square, or nearly square, compartments.

Whatever form is adopted for the silo, it should always be built with a greater capacity than would be necessary, as considerable allowance has to be made for waste from settling and from spoiled silage. Even if material is added a second or third time there will still be a certain amount of waste space to be allowed for. One-fifth is considered a low estimate for loss of space and waste silage.

As a basis on which to ascertain the size of silo necessary to hold food for a certain number of cattle for a certain period of time, 40 lbs. may be taken as the average amount of silage required to feed one animal per day, and 40 lbs. may also be taken as the average weight of a cubic foot of silage. Therefore, if the number of animals is multiplied by the number of days during which they have to be fed, the result will equal the number of cubic feet of silage space required. Supposing 30 animals have to be fed for six months, or 184 days, the total amount of space required would be 30 × 184 = 5,520 cubic feet.

To find the number of cubic feet in a square or rectangular silo multiply the length in feet by the width, and then by the height, and the result will give the total number of cubic feet. Thus, if a square silo measures 14 feet each way on plan and 25 feet in height the cubical contents would be 14 feet × 14 feet × 25 feet = 4,900 feet.

In the case of a round silo, multiply the square of the diameter in feet by the height, and then by .7854. For example, if a round silo measures 14 feet in diameter and 25 feet in height, the cubical contents would be 14 feet × 14 feet × 25 feet × .7854 = 3,848 feet approximately.

As regards position, the silo should be placed as near as possible to the centre of feeding to minimise the labour of carrying food to the various mangers. In round or octagonal farm buildings, such as are common in America, the silo usually takes the same shape as the main building, and is placed in the centre, where it occupies a convenient position from which to feed the various animals stalled around the building. In the accompanying plate a circular silo is shown situated at a corner of the main building, where it not only proves a useful adjunct but also forms a very pleasing feature. A convenient arrangement is to have the doors of the silo opening into a passageway, or into the feed store or mixing room, which usually occupies a central position. A saving in the cost of erection can often be effected by utilizing one or more of the walls of the main building in the construction of the silo.

The material to be used in the construction of a silo would probably be decided by local conditions. That most readily obtained in the locality in which the silo is to be built would naturally be chosen, provided it fulfils the conditions required for a good silo. Metal has been tried in some countries, but has not been found satisfactory, on account of the initial cost and the readiness with which it yields to the corroding action of the silage juices. In America, wood has hitherto been very largely used in the construction of silos, on account of the abundance of timber in that country and the comparative ease and cheapness of erection, and wood is considered one of the best materials for the preservation of silage. It is not likely, however, to be much used in this country on account of its scarcity and want of durability.

For durability, either stone or brick, or a combination of both, is to be recommended, preferably the former; and as either the one or the other can usually be readily obtained throughout the Transvaal, they are likely to enter largely into the construction of silos.

Whatever material is used—whether stone, brick, or wood—the foundation should always be of some material that is not subject to early decay, more particularly if it extends for some depth below the surface of the ground. In a dry soil a good quality of brick or stone

built with lime mortar is sufficient, but if there is a tendency to dampness, either cement concrete or stone, built with cement mortar and plastered on the outside with any damp-proof composition, forms the best foundation. It is important that the foundation should go down to a solid bottom, and it should extend a few inches above the highest point of the ground, and be covered on top with a damp-proof course to prevent moisture from rising to the structure above.

If the silo is built on a soil that is dry all the year round no other floor is necessary. Broken stones might be laid over the floor to a depth of 6 to 8 inches, and then covered with a layer of clean, dry earth or ant heap, and rolled or rammed till a compact and even surface is formed. Such a floor could only be used where the ground is sufficiently dry and where there is no danger of destructive insects or vermin entering through the floor. In other cases a floor of cement concrete should be laid, 4 to 6 inches thick, on a bed of broken stones, as above described, and tile-pipe drains might also be put in to carry off the water to some lower level.

The thickness of the walls depends greatly on the material used in the construction and the size of the silo. The larger and deeper the silo the greater is the pressure on the walls, and with an increase of pressure there must be a corresponding increase in the thickness of the walls. For a silo of the capacity referred to in the preceding pages, built with stone, the walls should be at least 22 inches thick at the base, but may be diminished to 16 inches at the top, where the pressure is considerably less. If built with brick, the thickness might be 22 inches, or 2½ bricks, at the bottom, diminishing to 14 inches, or 1½ bricks, at the top. Stout hoop-iron bands or iron rods are frequently built into the walls to strengthen them, particularly near the doors, where the proximity of so many openings tends to weaken the masonry.

To facilitate the settling of the silage the inside of the walls should be plastered to a perfectly smooth and even surface, with a good thick coating of cement plaster, which must be of the very best quality, and well put on, as the acids in the silage are apt to soften it and cause it to crumble away. The outside face of the walls should be plastered with lime or cement plaster if built with an inferior quality of bricks, but if a good class of bricks is used in the construction they may be left exposed, the joints only being filled up or pointed with lime or cement mortar. In the case of stone walls the joints between the stones should be raked out and pointed with cement mortar.

Any of the materials in general use may be used for a roof covering, and any form of roof may be adopted, provided adequate provision is made for filling the silo and also for ventilating it during the process of fermentation. The "lean-to" roof does not fulfil these conditions, and is seldom used. The ordinary pitch roof with a gable at either end, or the pyramidal or conical roofs shown on the accompanying diagrams, are undoubtedly the best forms, as they allow for the filling door being placed either in the gable or on the slope of the roof, and also admit of proper ventilation being arranged for. With a roof of corrugated iron, which is the covering most commonly used in this country, the slope of the roof need not be very steep, and the timbers forming the trusses need not exceed 4½ inches × 1½ inches, or 6 inches × 1½ inches at most, according to width of

silo. A ventilator should be placed at the apex of the roof, and openings should be formed at the eaves to create a draught and assist in carrying off the foul air and gases rising from the silage.

The doors required for a silo consist of a filling door placed in the gable or in the roof, above the highest point to which the silage is filled, and three or four emptying doors placed one above the other at convenient intervals apart and usually on one side of the building. The filling door should be large enough to freely admit the carrier, say 2 feet 6 inches wide and 3 feet to 4 feet high, according to available space, and should be placed at the side most convenient for filling. The cut fodder is conveyed straight from the cutting machine through the filling door to the centre of the silo by means of a carrier or an elevating tube, up which it is forced by air pressure.

The doors through which the silage is emptied should be about 24 inches wide and 30 inches high, one being at the top and one at or near the level of the ground, and the others spaced at intervals of about 4 feet apart vertically. They should be of well-seasoned timber, strongly made to resist the excessive pressure and heat, close fitted to exclude all air, and placed flush with the inside face of the wall. The doors may be hinged to the frame, or they may simply be put in place while the silo is being filled, and suspended with chains to the wall when not in use; the former method being perhaps the more satisfactory. To make the doors more perfectly air-tight thick felting is sometimes tacked to the frame, and stout paper is often pasted over the doors for the same purpose.

In most cases it will be found of great advantage to have a vertical chute attached to the silo, down which the silage can fall when emptied from any of the doors. It is made in the form of a long box, extending from near the ground to the top of the silo, and covering the doors. It requires only three sides, the wall of the silo forming the fourth, and should measure about 2 feet 6 inches by 2 feet inside. A ladder running up the full height is fixed inside the chute, giving access to the doors when the silo is being filled or emptied. The bottom end may be left open or may be fitted with a sloping bottom to slide the silage into a cart, barrow, or other receptacle used for conveying it to the cattle. A small door can be formed in the front or side to give access to the ladder.

The accompanying diagram (Plate 62) shows a square silo measuring 14 feet each way on plan and 25 feet in height, and having a capacity of 4,900 cubic feet, equal approximately to 98 tons of silage. It is on the lines described in the preceding paragraphs, built of stone in lime mortar, covered with a roof of corrugated iron, and having a floor of cement concrete 5 feet below the ground level. Four emptying doors are shown on one side and a filling door in the roof. There is a triangular ventilating panel over the filling door and a large ventilator at the apex for escape of foul air, and for the admission of fresh air there is an opening of about 4 inches high between the walls and the roof all round. The inside corners are shown well rounded to facilitate the settling of the silage. Though shown standing alone, it need not necessarily do so, but could be attached to other buildings where found most convenient.

Such a building, if erected by contract at current prices, would cost approximately £280, but a farmer could build it much more cheaply by employing local tradesmen and providing all necessary transport and native labour.

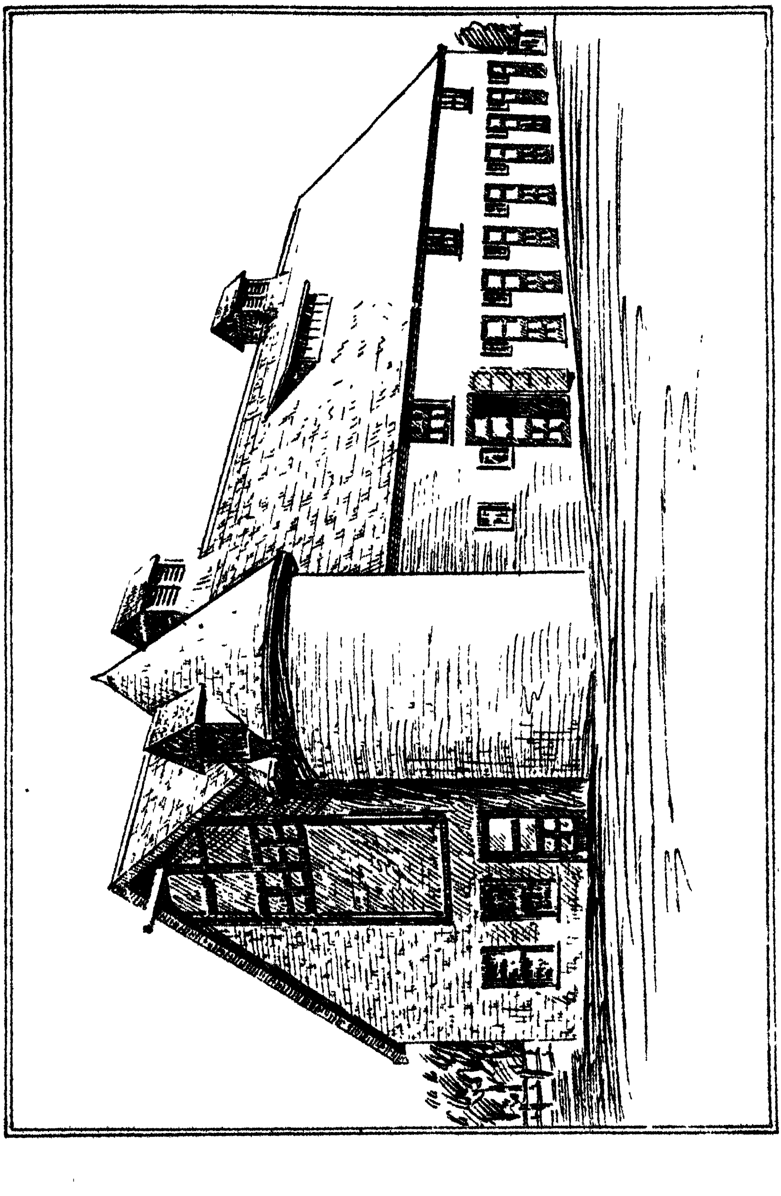


Plate 61. **Round Silo.**

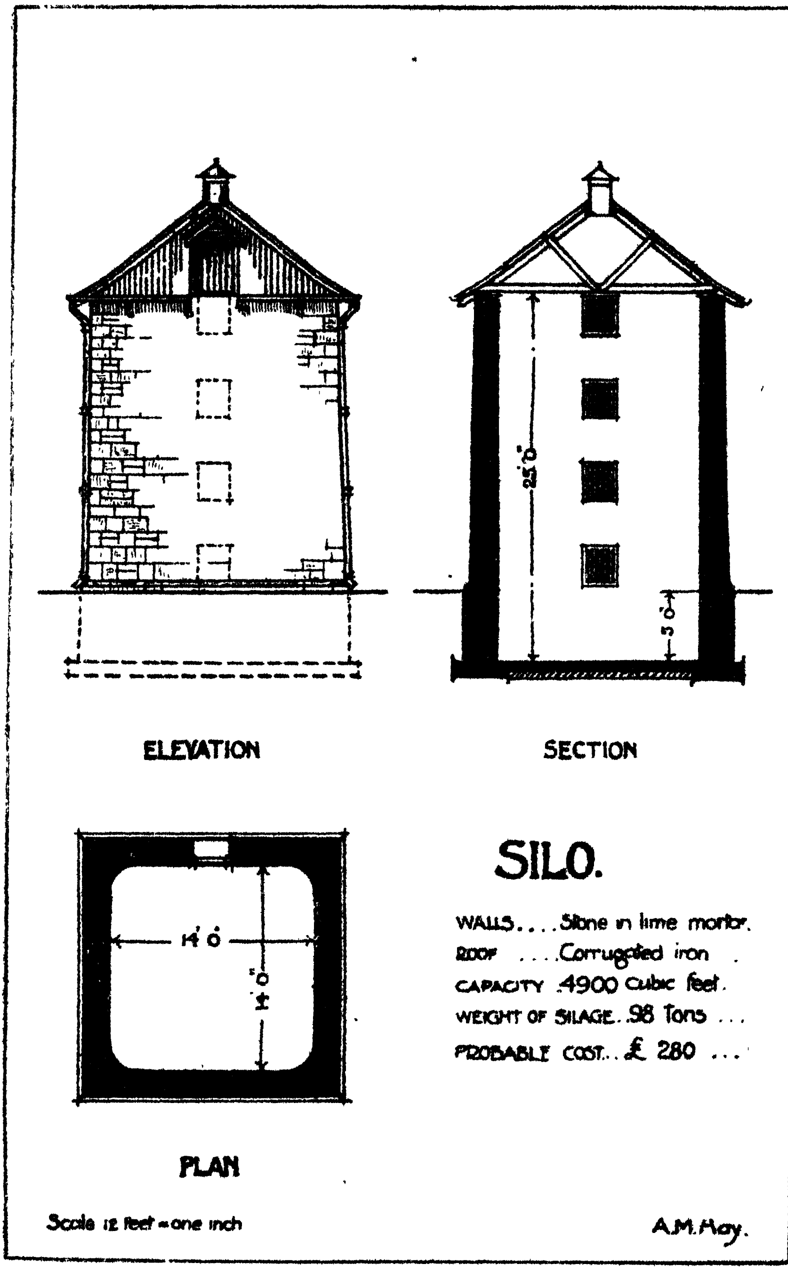


Plate 62. **Square Silo.**

The Veterinary Section.

1.—THE NURSING OF SICK ANIMALS.

By J. M. Christy, Assistant Principal Veterinary Surgeon.

Too much attention cannot be given to this subject. My experience is that owners are far too liable to place implicit faith in medicinal remedies, and are either ignorant of how to nurse their patients through serious attacks of illness or are too negligent to do so. Proper medicines intelligently administered play a most important part in combating all forms of disease, but to be successful they must be backed up by good nursing. We have all heard well-intentioned but ignorant people extolling the medicinal virtues of anti-friction grease, paraffin oil, and gunpowder, but seldom hear them speaking enthusiastically about nursing, which is a troublesome thing, calling for energy and patience.

The most important duties of any one in charge of sick animals is to see that his patients are made as comfortable as circumstances will admit, that proper food only, and at regular intervals, is given, and that any medicine prescribed is administered exactly according to instructions. I do not assume to dictate to any man, but a quarter of a century's experience in dealing with sick animals has impressed forcibly on me the good results following careful, intelligent nursing, as opposed to indiscriminate administration of drugs, each of which is supposed to be a specific for the particular trouble for which it is given. There are few specific remedies for any of the many ills the animal body is heir to. The bodies of all animals undergo disintegration and waste, and their growth and repair require continual recuperation. By digestion and assimilation the food materials are prepared for their special uses, and build up or maintain the body at its normal standard. In health, food must be provided in sufficient amount, of suitable quality, and with its several constituents in fitting proportion to furnish nutriment for every tissue. Water, which constitutes four-fifths of the total weight of most animals, is being constantly removed by the lungs, skin, kidneys, and intestines, and, unless restored at short intervals, thirst and impaired health ensue.

Not only are water and watery fluids requisite for the normal nutrition of the tissues, and for dissolving and carrying away their waste products, but in sick animals they also assist the removal of the products of disease.

Even more imperative is the need of pure air to oxygenate the blood, maintain internal respiration and normal tissue change, and remove waste products. These requirements, essential in health, are even more important in animals affected by disease. Food, then, requires to be given with especial care, and in an easily digested form, for in all serious diseases the digestive functions are impaired. In many febrile complaints the ordinary foods being imperfectly digested and assimilated are apt to produce or aggravate gastric derangement. Animals suffering from febrile and inflammatory disorders should therefore be restricted to easily digested foods, such as mashes, gruels, etc., given at short intervals, to which extra

nutritive value can be given, as required, by addition of milk, eggs, or meat extract. Food should never be allowed to lie long before a sick animal. If not promptly eaten, it should be removed, and in a couple of hours or less time replaced by a fresh supply. During and after attacks of debilitating diseases, patients fed, as they should be, on small quantities of rapidly digested fare obviously require food more frequently than in health.

With returning appetite a convalescent occasionally greedily eats more than can be easily digested, and against this contingency well-intentioned attendants require to be warned. Relapses of stomach and bowel troubles sometimes occur by allowing animals, immediately after recovery, their full allowance of food.

There are few diseases, if any, in which animals injure themselves by taking too much water or watery fluids, but they are often rendered uncomfortable and injured by undue restriction. A supply of water should always be within the patient's reach. Cold water seldom does harm, and is more palatable and refreshing than when tepid.

In towns, particularly, much mismanagement occurs with regard to the ventilation and temperature of the habitations of sick animals. Draughts should be avoided, but cool air should be freely admitted, and the stable, kennel, etc., kept scrupulously clean.

No restorative or tonic is so effectual as cool, pure air, and it is especially needful in diseases of the respiratory organs, or of a lowering or wasting nature, such as influenza in horses and distemper in dogs.

Sunlight is also an essential factor in the promotion of health, especially in the young. It increases the capacity of the blood and tissues for oxygen, favours healthy excretion, and is an excellent disinfectant. In the Transvaal it would be undesirable to allow the direct rays of the sun to play for any length of time on a sick animal; if a suitable stable or shed is not convenient a shade of some kind should be improvised.

A comfortable bed greatly conduces to the restoration of most sick animals. A sick, exhausted horse, who to his disadvantage would continue to stand if kept in a stall, will often at once lie down and rest if placed in a comfortable box or nice shady place with a proper bed.

In febrile and inflammatory attacks, and during recovery from exhausting diseases, it is desirable to conserve the bodily heat. For this purpose a warm rug or two, and bandages to the legs, do good. They help to maintain equable temperature and combat congestion of internal organs, but at least twice daily these rugs and bandages should be removed, the skin wisped over, and the clothing at once replaced.

Attention to the position of the patient is frequently important, and must be seen to; thus a horse allowed to lie for any great length of time on one side is liable to suffer from congestion of the lung on the under side; cattle when very sick, if allowed to occupy the same recumbent position for any length of time are liable to become tympanitic, and their chance of recovery is thereby seriously impaired. Sick animals should never be allowed to lie prone in any one position for a long period, turn them over occasionally, and hand rub the parts they have been lying on; this will assist local and general circulation and contribute materially to

their general comfort and ultimate recovery. The feeding of sick and convalescent animals is of the greatest importance; the guides are, give nothing difficult to digest, tempt the appetite, but do not overload the digestive tract.

To sum up, in dealing with sick animals we should use our common sense, which dictates that we should pay particular attention to the patient's general comfort, his dieting and watering, and only administer medicinal remedies whose action we understand, or that from previous experience we know to be beneficial in the particular trouble with which we have to contend.

II.—THE CHANNELS BY WHICH MEDICINES ARE ADMINISTERED.

By J. M. Christy, Assistant Principal Veterinary Surgeon.

It may be trite and stale to say that before we think about giving curative agents to animals we should know how to do so. The Veterinary Division of the Department of Agriculture has taken to heart the advice of the Right Hon. the Minister of Agriculture, who has pointed out that not the least of our duties is to educate, explain to, and instruct, the stock-owners of this country how to treat their animals in health and disease.

Bearing this advice in view, it has occurred to me that a short article on the abovementioned subject would be useful and of interest to the readers of the *Agricultural Journal*. People frequently say to me when I tell them to give their animals certain medicines, "But how are we to do so?" No good end would be gained by going deeply into the subject, therefore for convenience of description and simplicity of detail I shall deal with it in ordinary language and as concisely as possible.

Medicines may be administered by injection into the subcutaneous areolar tissues, the trachea (windpipe), veins, glands, muscles, rectum, udder, uterus, and large serous cavities, but the most frequent and generally the most convenient mode of administration is by the mouth.

Shortly, the channels by which medicines can be administered to animals are as follows, namely:—

(1) The digestive tract: generally by the mouth, at times per rectum.
(2) The pulmonary mucous membrane: (*a*) by inhalation, (*b*) by intratracheal injection, (*c*) by nasal insufflation.
(3) Intravenous injection.
(4) The skin.
(5) Hypodermically: by injection into the subcutaneous cellular tissues.

1. The Digestive Tract.

The mouth is the channel by which medicines are most frequently administered, for they immediately pass into the stomach and intestines, whence they are readily and rapidly absorbed into the system.

There are various ways by which medicines can be given by the mouth. We mix tasteless or pleasant-tasted medicines with the food or water, and they are as a rule readily partaken of; in this way the usual tonic powders and alteratives, such as small doses of epsom salts, etc., are given. Dogs and cats will often bolt nasty-tasted medicines rolled up in a piece of meat. The other ways by which medicines can be given by the mouth are (*a*) by drenching, viz.:—By pouring the medicine in a liquid form from a bottle or drenching horn slowly into the mouth and allowing the animal to swallow it gradually. On no account must any part of the drench be given through the nose; this is sometimes done with the idea of making the animal swallow, and usually results in some of the liquid getting into the lungs, causing broncho-pneumonia if not death at once by asphyxia.* (*b*) As a powder on the tongue. Shake the powder on the back of the tongue and wash it down with a little water from a bottle. (*c*) As a ball or pill. Balls are used for horses and cows, pills for dogs, cats, pigs, sheep, and birds. Many instruments are on the market for giving balls to horses, none of them are really satisfactory. The best way is to give the ball with the hand. This, however, requires practice and experience. Do not put the ball on a sharp pointed stick and attempt to force it down the horse's throat, as by doing so the chances are that the sharp end of the stick may cause serious injury to the back of the mouth or throat. Several cases of this sort of injury have come under my notice. To give a pill open the mouth wide, pull the tongue out a little, drop the pill on to the back of the tongue, let go the tongue and close the animal's mouth. (*d*) As an electuary. Here the medicine is made up in a semi-liquid state with treacle or something of about the same consistency, and is placed on the back of the tongue or between the back molar teeth either with the fingers or with a spoon. (*e*) By the probang. In extreme cases the probang is passed through the mouth and oesophagus into the stomach, and medicine passed down through it; this should only be done by a properly trained and experienced veterinary surgeon. It is not a thing for the layman to attempt, even if he had the appliances. Recourse is only had to it when the animal is in an unconscious condition and unable to swallow. In cases of colic and intestinal parasites infesting the end bowel, medicines are frequently given per rectum with what is known as a clyster syringe, or, where such is not available, with a piece of india-rubber tubing, improvised funnel, and bucket. Further, in some other cases where it is difficult or impossible to give medicine by the mouth it is given per rectum, as we know that although absorption is not so active from the posterior portions of the digestive tract soluble medicines introduced into the rectum enter the circulation and act on the general system.

2. The Pulmonary Mucous Membrane.

The membrane covering the air-passages has a superficies fifty times as large as the skin; it actively absorbs substances in the gaseous form, and therefore lends itself readily as a channel by which medicines in such a form can be introduced into the system. (*a*) By inhalation through this

* For drenching horses there is a very useful instrument on the market which can be obtained from most up-to-date saddlers, or instrument makers. It consists of a hollow perforated bit, with a tundish arrangement fitted to one side of it, the bit is put in the horse's mouth, his head elevated somewhat and the liquid poured slowly into the tundish, when the horse drinks it. No large stable should be without an instrument of this kind. It does away with a lot of trouble and minimises the risk of the drench entering the lungs.

channel anaesthetics such as chloroform, etc., are administered when their general effects are required; also medicated vapours to relieve morbid conditions of the respiratory passages. Further, in this way diluted sulphurous and chlorine gases can be given to destroy worms in the tubes of the lungs. The administration of anaesthetics for general effect should only be done by skilled veterinarians, or fatal accidents may occur; it is work calling for special training. Medicated vapours can be given by putting the medicine in a bucket of hot water or in a nose-bag filled with hot moist bran and allowing the animal to inhale the steam. Of course, medicine to be given in this way must be volatile, such, for example, as eucalyptus oil. Sulphurous gases can be given to animals by placing them in a closed shed or stable and throwing some flowers of sulphur on live coals, but when doing this the animals should be carefully watched lest they become poisoned or gassed by the fumes. (*b*) By intratracheal injection. This, though a simple operation in itself, should only be done by properly trained men. To carry it out a syringe is required. Special syringes for the purpose can be obtained, but the ordinary hypodermic syringe can be used in cases of emergency. In practice I have found it useful to use an ordinary rowelling scissors to cut the skin, which enables one more easily to get at the trachea. The needle of the syringe should be gently introduced between the rings of the trachea (the windpipe) and the medicine forced slowly through it. As a guide to know that the needle is in the tube of the trachea you will hear the air passing in and out of the end of the needle with a hissing sound as the animal breathes. Further, the animal usually gives a short cough as the medicine passes into the lungs, and immediately afterwards you can detect the scent of the medicine in the animal's breath. Agents such as carbolic acid, turpentine, iodine, creosote, and chloroform can be introduced in this way into the tubes of the lungs for the purpose of destroying worms in them, or to combat serious systemic disorders. Of course, these medicines must be dissolved in suitable carriers, otherwise they would act as irritants and probably cause death. (*c*) By nasal insufflation. In this way powders can be blown up the nose to remove parasites from, or heal sores in, the nasal cavities. It is not a method to be recommended except in exceptional cases.

3. Intravenous Injection.

This method is resorted to when immediate effects are desired. The injection should be diluted, non-irritant, and introduced slowly, with strict attention to antiseptic precautions. Special instruments are required for it, but the hypodermic syringe can be used in cases of emergency. The introduction of air, the formation of clots, and septic contamination must be avoided. The jugular vein is as a rule the most convenient one by which to give intravenous injections, but any vein that can be got at will do. The transfusion of blood from one animal to another is done intravenously; this is a matter for the skilled man only, therefore I shall not here deal with it further.

4. The Skin.

Many medicinal agents are applied to the skin, most of them—such as counter-irritants, caustics, and poultices—for the production of local effects or of reflex actions exerted on adjacent or distant parts. With this object in view we apply caustics and counter-irritants to abnormal growths, and

blisters and hot water medicated stupes to the chest or abdominal walls in chest and abdominal troubles of an inflammatory character. Further, in splints, curbs, spavins, etc., we blister over the seat of same with a view to causing a cure by counter-irritation.

5. Hypodermically: By Injection into the Subcutaneous Cellular Tissue.

The hypodermic administration of curative or preventive agents consists of their injection in a liquid form into the loose tissue underlying the skin, or occasionally into the substance of a muscle. They thus enter the blood stream unaltered by contact with the contents of, or secretion of, the digestive canal. They escape the changes which many substances undergo in the liver, and hence act more certainly and rapidly. Hypodermic injection is specially indicated:

(*a*) Where rapid energetic effects are required, as in poisoning, threatened collapse, and the paroxysms of acute pain, as in spasmodic colic.

(*b*) Where it is desired that the drug should act promptly and directly on the diseased part, as in rheumatic pains and mammitis in cows.

(*c*) Where local and general effects are desired to be conjoined, as in injuries to the head and spine.

(*d*) Where administration by the mouth is difficult, impossible, or inadvisable.

Drugs used in this way should be non-irritant, and soluble in alcohol, water, or glycerine. Morphine, atropine, ergotin, physostigmine, arecolin, and many other active drugs are now used hypodermically for arresting or controlling the spasms of colic and the inflammatory pain of enteritis and pleurisy, as well as for combating the effects of poisons. Where pain is to be counteracted, the injection is made deeply near the affected spot, or over the nerve which is believed to be conveying the disordered impression. The hypodermic syringe has a glass barrel, a tight-fitting piston with handle, and to the nozzle is fitted a hollow needle.

It is essential that the syringe be perfectly clean, and the needle sharp. Hypodermic injection is very simple. Choice is generally made where the skin is thin and the subcutaneous tissue loose, as behind the elbow or at the lower part of the neck. A fold of skin is taken up between the finger and thumb of the left hand; the needle, detached from the syringe, is passed through the skin and carried for about an inch obliquely under the surface. The nozzle of the filled syringe is then attached to the needle, the piston slowly pushed home, and the instrument cautiously withdrawn. The puncture requires no plaster or dressing.

I am indebted to Mr. S. F. Naude, of this Department, for the sketches which help to illustrate the article.

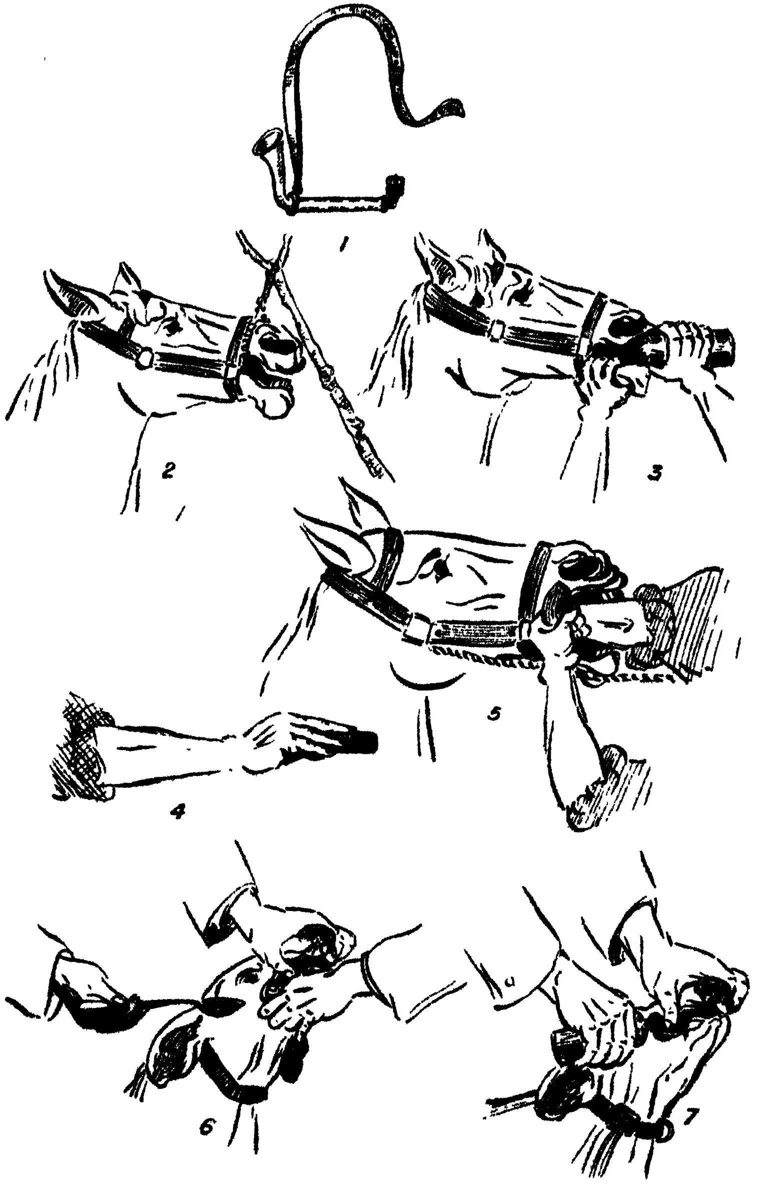


Plate 63.

Method of administering Medicines to Animals.

Fig. 1: Drenching bit. Figs. 2 and 3: Drenching the horse. Figs. 4 and 5: Balling the horse; (4) method of holding the ball. (5) how to administer the ball. Figs. 6 and 7: Administering medicine to a dog; (6) with a spoon, (7) from a bottle.

The Chemical Section.

1. THE FOOD OF PLANTS.

BY R. D. WATT, M.A., B.Sc., F.C.S.

IT is a fact becoming more evident every day that success in any undertaking depends largely on knowledge. A better understanding of the requirements of plants ought, therefore, to help every cultivator in his growth of crops. We daily see before our eyes plants growing in size and producing flowers and fruits and seeds, which cannot be made out of nothing. What, then, is the source of the new tissues of plants? In other words, of what does the food of plants consist?

When a plant is grown from seed—and all agricultural plants, with which alone I mean to deal, are grown originally from seed—it is not difficult to understand the source of its food in the early stages. For every seed consists essentially of two things, namely, an embryo or baby plant and a store of food. When the necessary conditions as to heat, air, and moisture are fulfilled this embryo plant begins to grow, sending down into the soil roots and into the air green leaves.

Now the obvious source of these new tissues is the food stored in the seed, chiefly starch and protein. When moisture is absorbed by the seed the insoluble foodstuffs are made soluble, become dissolved in the water, and pass on to the growing parts.

But this cannot go on for a long time, as the store of food, especially in small seeds like those of the tobacco plant, soon becomes exhausted. Before the food in the seed is exhausted let us see how the plant is equipped to carry on the battle of life. Above ground it has a short stem with one or two green leaves growing on it, and underneath it has one or more rootlets with perhaps some branches, and part of each of these is covered with very tiny, thin *root-hairs*. These are what the plant has got, and nothing more. By means of one or other or all of these organs, then, the plant must now get its food. The roots have by this time taken a firm grip of the soil, and are in close contact with the soil particles, which ought all to be surrounded by a thin film of water, while the leaves are in contact with the atmosphere (air). It is quite conceivable, therefore, that the young plant may be absorbing water and other things from the soil and that the leaves may be taking in air. But neither soil nor water nor air is consistent with our idea of "food," and they are in no way to be compared with the food which the young plant has been deriving from the seed. Here we seem to have come against a stone wall, for it seems impossible to find the source of the plant's food supply.

Is there no way out of the difficulty? Yes, there is; and the solution of the question is by far the most important fact in nature from the point of view of the food supply of both plants and animals. And the solution is this, that *the plant makes its own food.** Were

* Many people talk about water, carbon-dioxide, and "salts" or "minerals" as the food of plants, but the above is perhaps a more rational way of viewing the subject.

it not for that fact the existence of life on this earth would be an absolute impossibility, for otherwise we might ask of nature for bread, and she would give us a stone.

But if a plant makes its own food it must make it out of something, and if we only knew the nature of that "something," and could see that our crops are provided with every ingredient of that "something," and that all the conditions were as favourable as possible for the production of plant food from that "something" (plant food material) we should have found the secret of the growth of all crops.

I think that it will already be obvious that the only possible sources of a plant's food material are the air, and the soil with the water it contains. Now, if we examine a plant under a powerful microscope we shall see that there are no holes in either the roots or the leaves large enough for the entrance of any *solid* particles of any size. We are therefore driven to the conclusion that the material out of which a plant makes its food must enter it either as a liquid, like the water we drink, or as a gas, like the air we breathe.

Is it then from water or from air that a plant makes the food from which it builds up its tissues and increases in size? It would not be quite correct to say that it is from both, because it is from a certain substance in the air, called carbon-dioxide, and from the water with something dissolved in it.

The next questions that naturally arise are, where does the plant make its food and what machinery does it use? If we examine a plant under the high-power microscope we find it to be composed of a very large number of cells, closely packed together like a honeycomb, and in every living cell we find a jelly-like substance which is called "protoplasm" or the "living matter" of plants. Now the protoplasm occurring in the leaves and green parts of plants is different from that found in any other part, in this respect, that it has embedded in it certain little green bodies which are just extra rigid pieces of protoplasm coloured by a green substance called "chlorophyll."

All we know about a plant's method of manufacturing its food is that it absorbs through tiny openings in its leaves carbon-dioxide from the atmosphere, and by means of its root-hairs water with some substances, dissolved in it from the soil, and that out of these, under the action of sunlight, these little green bodies embedded in the protoplasm make what is the beginning of all the food in the world. And every time you see a green leaf you can look at it and say that, with the help of the sun, it is doing what the greatest scientists who ever lived have not been able to do, namely:—It is making sugars and similar foods, out of carbon-dioxide and water with a small quantity of inorganic or mineral substance dissolved in it.

Now we come to the practical question of how we can help plants to increase their food supply. The quantity of carbon-dioxide in the atmosphere is quite sufficient for the needs of all plants, and is fairly constant all the world over, so that it would be impossible to benefit our crops by attempting to increase the amount of this. It would

be almost equally futile, on a large scale, to modify the intensity of the sun's rays; so our attention must now be confined to the substances our plants get from the soil.

Every one knows how necessary water is to the growth of plants, and this is especially true in a country like South Africa, as is evidenced by the multiplication of irrigation schemes and the increased attention given to the conserving of the soil moisture by what is now universally known as "dry land farming."

Of the sources of a plant's food material there only remain to be considered those which are dissolved in the soil water. I believe that if one were to ask a hundred people where plants get the material for building up their new tissues, at least ninety would reply that the greater part comes from the soil. And yet a little thought would show that this is impossible. For how would one account for the fact that the soil on which a forest of huge trees is growing never seems to get any less or that a very large plant can sometimes be grown in a very small flower-pot without renewing the soil?

As a matter of fact only a small percentage (1 to 5 per cent.) of ordinary plants in the green state comes from the soil. If we dry a plant and burn it the greater part disappears into the air as water-vapour (steam) and carbon-dioxide, while only a small quantity remains behind as the "ash." And now we have got back to what we originally started with. The part of the plant which has been derived from water and carbon-dioxide has gone back into the atmosphere in the forms in which they were absorbed by the plants, and *roughly speaking, the part which came from the soil remains behind as the "ash."

By means of innumerable experiments it has been conclusively proved that certain substances, and these only, require to enter the plant, dissolved in the soil water. It is impossible to tell you what these substances are without using scientific names, and the following is the complete list, viz.:—Nitrates (containing nitrogen), sulphates (containing sulphur), phosphates (containing phosphoric acid), potash, lime, magnesia, and iron. But, although these are the only substances essential, certain others, such as soda, silica, and chlorine, are almost invariably present in plants, and they are also derived from the soil.

The following experiment (see Plate 64) was carried out by the author to illustrate the effect of depriving a plant of one or other of the essential ingredients of its food material. The method adopted was that of "water culture," i.e. the plants (barley) were grown in glass vessels containing water, to which were added small, carefully weighed quantities of the substances a plant usually gets from the soil—not more than one-quarter of an ounce in each case. Now this is rather an unnatural way in which to grow ordinary agricultural plants, but it has the advantage of showing the root development and of the possibility of supplying the plants with exact quantities of different substances.

* Part of the nitrogen escapes into the air and part of the material derived from carbon-dioxide remains behind as carbonates.

During the growth of the plants the glass cylinders were kept in the dark, and only the leaves and stems exposed to the light in imitation of nature's plan. It will be seen that the plants were equally favourably situated as far as acquiring carbon-dioxide and water were concerned, so that the differences in growth must have been due to differences in the supply of what are generally called the "mineral" food materials.

Pot 1 contained all these necessary "mineral" ingredients, with the result that the barley plant grew to maturity and produced grain.

Pot 2 had added to it exactly the same substances as Pot 1, except that no combined nitrogen (nitrate) was supplied. The barley grew quite vigorously at first, but when the nitrogen contained in the seed was exhausted the plant died of nitrogen starvation.

Pot 3 was exactly the same as Pot 1, except that phosphoric acid (phosphate) was left out, as a result of which there was practically no root development, and here, too, the plant soon died off.

Pot 4 contained no potash, but was otherwise the same as Pot 1; and, though the barley grew for a considerable time, it showed no tendency to produce grain.

Pot 5, with no lime, produced a plant which also grew quite vigorously at first, but gradually got weaker and died of lime starvation.

Pot 6, which had no magnesia, showed the best growth of all, except No. 1, but it also failed to reach maturity.

The series would have been quite complete if there had been other two cylinders, in one of which iron had been wanting and in the other a sulphate, and I have no doubt but that similar results would have been obtained in these cases.

Now, although no soil is absolutely devoid of any of these substances, it will readily be understood that a deficiency of any one of them in the soil will result in feeble plants and a poor crop. And, just as the strength of a chain depends on the weakest link, the growth of a crop depends on that essential ingredient which is present in smallest quantity in an "available" form. Except in rare cases the only plant food materials likely to be present in insufficient quantity in a soil are nitrogen, phosphoric acid, potash, and lime. The amounts of these usually found in a Transvaal soil are, roughly, two parts each of lime and potash, one part of nitrogen, and half a part of phosphoric acid per 1,000, while both the lime and the phosphoric acid are sometimes as low as one part in 10,000. Even these small quantities would be sufficient to last a maize crop for several years if all that were present in the soil were in an "available" form.

We have previously seen that the materials derived from the soil enter the root-hairs, dissolved in the soil water, so that to be "available" means to be soluble in the soil water. This water will dissolve some things that are not soluble in pure water, as it is assisted in its action by small quantities of certain acids (chiefly carbonic acid).

Not more than one-tenth part of the potash and phosphoric acid present in the Transvaal soils is usually in an "available" form. Even a smaller proportion of the nitrogen is in an available form, but in a good soil in this country, under cultivation, its soluble form (nitrate) is generally being produced quickly enough for plant requirements.

Apart from the water supply, then, the whole problem of the successful growth of crops centres round increasing the available plant food material in the soil; and there are only two ways of doing this, cultivation and manuring.

Cultivation helps to render "available" the store of available plant food in the soil, whilst manuring actually supplies that plant food material in an available form.

Now, if one were to put the question with regard to the Transvaal, "What is the weakest link in the chain? What is the substance the insufficiency of which is limiting the growth of our ordinary crops?", we would have two ways of testing the matter. The one is making a chemical analysis of the soil, and the other is to add to the soil each of the ingredients likely to be deficient both alone and in various combinations, i.e. by field manurial experiments. Both of these tests point to phosphoric acid as being the weakest link, though frequently lime, nitrogen, or potash is deficient as well.

SUMMARY.

1. In its early stages a plant gets its food from the seed, tuber, or other food-storing organ from which it grows.

2. As soon as the young plant is equipped with roots and green leaves it can make its own food.

3. The raw materials used by the plant in making its food are carbon-dioxide (derived from the air) and water, with certain "mineral substances" (or salts) dissolved in it which enter by the root-hairs and rise up to the leaves.

4. More than 95 per cent. of the weight of green plants is derived from carbon-dioxide and water.

5. The ash of plants represents, roughly, the "mineral" ingredients which have come from the soil.

6. These substances derived from the soil are, however, of the utmost importance.

7. The names of these essential "mineral" substances are nitrates, sulphates, and phosphates of potash, lime, magnesia, and iron.

8. In order to be absorbed all these substances must be present in an "available" form: that is, they must be soluble in the soil water.

9. Except in rare cases the only essential food materials likely to be deficient in soils are nitrates and phosphates of potash and lime.

10. These deficiencies can be remedied by cultivation and manuring.

II. MANURIAL EXPERIMENT WITH POTATOES.

By R. D. Watt, M.A., B.Sc., F.C.S.

The nineteenth century of the Christian era was more remarkable than any other of which we have any record for the progress made in every branch of applied science. Some people have the idea that agriculture—the oldest of human industries—did not show an advance which corresponded with that made in other spheres. But this is not the case; for, especially in the second half of the century, the science of husbandry showed remarkable developments in all progressive countries. The study of the requirements of plant life then for the first time received the attention which it deserved, and the consequence was that the results of scientific research bore rich fruits in practice. Perhaps the most remarkable example of this was the gradual increase in the use of artificial manures, or fertilizers, designed to supply crops with those substances necessary for their existence, and which are apt to be deficient in soils.

In a comparatively new country like the Transvaal it might be thought that the use of such artificial fertilizers was quite unnecessary, and many have hastily concluded that their price in the Transvaal is so high as to preclude the possibility of their profitable use. From a consideration of the chemical analysis of a large number of Transvaal soils, the writer has from the first doubted this contention, and the result of the following manurial experiment with potatoes makes it perfectly clear that in many cases the use of fertilizers can be profitable even here.

The experiment in question was carried out in the closing months of last year on the farm Koedoespoort, a few miles to the east of Pretoria. This was made possible by the kind co-operation of Mr. Charles Weir, to whom I am indebted for the exceedingly careful manner in which he superintended the growth of the crop, and for the assistance he rendered in the measuring of the plots and in carefully sorting and weighing the produce of each.

Soil.

The soil might be described as a reddish brown clay loam, which on analysis was found to contain:—

	Per cent.
Moisture ...	6.60
*Loss on ignition (organic matter, etc.) ...	8.86
Insoluble matter (sand, etc.) ...	60.20
Oxide of iron and alumina ...	23.35
Lime ...	0.35
Magnesia ...	0.46
Potash ...	0.27
Phosphoric acid ...	0.08
	100.17

	Per cent.
*Containing nitrogen ...	0.125
"Available" potash ...	0.0096
"Available" phosphoric acid ...	0.0027

The soil is thus richer than the average run of Transvaal soils in total organic matter, lime, potash, and phosphoric acid, but, in common with the great majority of soils in this country, the amount of "available" phosphoric acid present is small. From a consideration of the chemical analysis one would therefore naturally expect it to respond to a phosphatic manure like superphosphate.

The soil had not been analysed when the experiment was started, but the results confirm in a very striking manner the value of a chemical analysis, and especially the reliability of Dyer's method for determining the amount of "available" plant food.

The land was "broken" from the veld for the first time in 1907, and had borne one crop of sorghum without manure.

Manurial Treatment.

The plots were seven in number, and each was one-eighth of an English acre in extent. The following list gives the order and manurial treatment of each plot:—

Plot I	Nitrate of Potash	200 lbs. per acre.
Plot II	Superphosphate	400 " " "
	Nitrate of Soda	200 " " "
Plot III	Superphosphate	400 " " "
	Sulphate of Potash	200 " " "
Plot IV	No manure.	
Plot V	Superphosphate	400 " " "
	Nitrate of Potash	400 " " "
Plot VI	Stable manure	10 tons " "
Plot VII	Stable manure	10 " " "
	and Artificial manures as Plot V.	

It is hardly necessary to remind the reader that artificial manures are designed to supply one or more of the following three ingredients, namely, nitrogen, potash, and phosphoric acid. Nitrate of potash, as its name indicates, supplies nitrogen and potash. Nitrate of soda is valuable for its nitrogen only; superphosphate supplies phosphoric acid; and stable manure contains all three, though not in ideal proportion for Transvaal soils. The stable manure was ploughed in some weeks before the potatoes were planted, and the artificial manures were sown in the drills immediately before planting.

The variety of potato used was "German Blue," and previous to planting the "seed" had been cut and treated with lime to prevent the drying-out of the potatoes from the cut surface. Planting took place on the 29th of August, and the crop was harvested on the 29th of December, so that the period of growth was exactly four months.

The land was irrigated once before the potatoes were planted, and the crop received two light irrigations after the plants were well through the ground. The season was exceptionally dry, and a much larger crop would doubtless have resulted if more water had been available for irrigation, or if more rain had fallen in December.

On the 14th of November I inspected the experiment, and found that very considerable differences existed in the plots. There were

very few blanks on any of them, but the plot which had received no manure was so much worse than the others that the drills could easily be picked out at a distance of half a mile. Plot I was next worst, and the others were fairly uniform, the "shaws" completely covering the drills. The drought in December (rainfall under two inches) caused the yield to fall short of earlier anticipation.

The following table gives a summary of the results:—

Plot No	Manurial Treatment.	Yield in lbs. per Acre. Saleable	Yield in lbs. per Acre. Small.	Value of Crop per Acre.	Value of Increase due to Manuring.	Cost of Manure per Acre.	Profit from Manuring per Acre.
				£ s. d	£ s. d.	£ s. d.	£ s. d.
I	Nitrate of Potash ...	4,214	416	35 19 10	4 1 5	2 6 10	1 14 7
II	Superphosphate and Nitrate of Soda	6,264	416	57 17 10	20 19 5	3 0 6	17 18 11
III	Superphosphate and Sulphate of Potash	6,232	608	52 18 11	21 0 6	2 18 8	18 1 10
IV	None	3 728	512	31 18 5	—	—	—
V	Superphosphate and Nitrate of Potash	6,176	608	52 9 7	20 11 2	3 17 6	16 13 8
VI	Stable manure	5,358	313	45 3 5	13 5 0	3 15 0	9 10 0
VII	Stable manure and artificials	6,414	684	54 11 10	22 13 5	7 12 6	15 0 11

The manures were purchased from the South African Fertilizers Company, of Durban, and the price quoted includes the cost of railage to Pretoria. It is only fair to state that if the manures had been got from the New Transvaal Chemical Company at Delmore, the prices would have been almost identical now that the latter company has reduced its prices.

The value of the crop is based on the price actually received for the potatoes (which were a particularly nice lot), namely, the very satisfactory figure of 25s. per bag, whilst an allowance of 5s. per bag was made for the "small." The objection may be raised that the price quoted is unnaturally high, but the fact remains that the above figure is that actually obtained for the potatoes. If the rainfall had been greater, the price would probably have been smaller, but, on the other hand, a larger crop would have been obtained, and the differences due to manuring would certainly have been much greater. That there can be no doubt about this is amply proved by the fact that small fragments of superphosphate could plainly be seen in the soil when the potatoes were ploughed out.

Even if the price of the potatoes had only been 10s. per bag, Plot III would have shown a profit of £5 11s. 6d. per acre as compared with the unmanured plot. At my request Mr. Weir made a very careful estimate of the cost of producing and marketing an acre of

potatoes without manure, and the figure arrived at was approximately £12. On this basis, with potatoes at 25s. per bag, the profit without manure was about £20 per acre, whereas it was about £38 in the case of land manured as Plot III. And if the price had been only 10s. per bag the profit, without manure, would have been about £1 5s. 6d., whereas the use of superphosphate and sulphate of potash would have raised the profit to £6 17s. per acre.

The Transvaal farmer likes to state his results in the form of the number of bags harvested from one bag of seed. The following are the results stated in that form in round numbers:—

Plot.	Manurial Treatment	One Bag "Seed" Produced
I	Nitrate of Potash	6 bags potatoes.
II	Superphosphate and Nitrate of Soda ...	9 " "
III	Superphosphate and Sulphate of Potash	9 " "
IV	None	5½ " "
V	Superphosphate and Nitrate of Potash.	9 " "
VI	Stable Manure	7½ " "
VII	Stable Manure, Superphosphate, and Nitrate of Potash	9½ " "

From whatever point of view, therefore, we care to regard the results, it is evident that wherever superphosphate has been applied a striking increase has been obtained, and my only regret is that we did not have a plot to which superphosphate alone was applied.

It will be noticed that the combined effect of nitrogen and potash (Plot I) is comparatively small, and this is quite in accordance with what might have been expected from the chemical analysis of the soil, which shows it to be fairly well supplied with both of these ingredients.

The question might be asked "How would the special potato fertilizers, sold by the different manure merchants, have compared with the treatment given to the different plots?" To quote an example, the following shows the analysis of a special potato fertilizer offered for sale in this country:—

Soluble phosphates, 18 per cent.
Insoluble phosphates, 8 per cent.
Nitrogen, 4 per cent.
Potash, 3 per cent.

It is evident that the manure merchants are on right lines, and understand the requirements of our soils, for they place phosphates (phosphoric acid) in the front rank and attach less value to the nitrogen and potash.

There is a popular fallacy in certain quarters that the use of artificial manures exhausts the soil. How it has arisen it is difficult to imagine, for exactly the opposite is the case, if they are judiciously used. It is too soon to have many proofs in this country, but the following example illustrates the point beautifully. In the annual report of the Government Botanist for 1906-07 the following yields of

maize are quoted from data supplied by Messrs. Hutchinson and Shaw, of Sandbaken, near Val Station:—

"Their whole mealie crop of 219 acres gave 2,514 muids, an average of 11½ muids per acre. Individual areas gave better returns, as follows:

(*a*) 13 acres, Hickory King, 19½ muids.
(*b*) 20 acres, Hickory King, 17½ muids.
(*c*) 35 acres, Hickory King, 15½ muids.
(*d*) 90 acres, Hickory King, 6 muids.
(*e*) 40 acres, Natal Yellow Horsetooth, 11¼ muids.

"The explanation of the difference in yield in different fields is instructive:—(*a*), (*b*), and (*c*), fertilized for potatoes the previous season, check-rowed by hand; (*d*) maize previous season, drilled with mealie-planter, no fertilizer; (*e*) most of this land had been fertilized for potatoes *three* seasons previously—it had been cropped every year since, once with manna, then maize, then maize again; (present crop), the residual value of the fertilizer was still very noticeable, the line where the potatoes stopped three years ago could be seen at a glance, the maize in the old potato land looking so much better."

From these results it looks as if the fertilizer gave quite as good a return the second year as the first, and that even then it was not exhausted. The particular fertilizer used by Messrs. Hutchinson and Shaw was partly the special potato fertilizer, whose analysis is quoted above, and partly a mixture corresponding closely to the manurial treatment given to Plot V in our experiment, and the quantity used was 600 lbs. per acre.

Summary and Conclusions.

1. The yield of the potato crop in this country can be greatly increased by the judicious use of artificial manures.

2. A dressing of superphosphate and sulphate of potash gave a profit of £18 per acre, as compared with the unmanured plot when the saleable potatoes were valued at 25s. per bag—the price actually received.

3. If the price had been only 10s. per bag, the profit from this manuring would still have been considerable.

4. The residual value of the manures would more than pay for the increased cost of growing and handling the larger crop obtained.

5. Stable manure considerably increases the yield of potatoes.

6. The yield is still further increased by the addition of artificial manures, especially superphosphate, to the stable manure.

7. The best potato manure to use depends largely on the analysis of the soil, but on most of our soils some fairly soluble form of phosphate should be the chief ingredient.

8. The special potato fertilizers of the different manure merchants are well suited to the requirements of our soils.

III. NOTES FROM THE CHEMICAL LABORATORIES.

By R. D. Watt, M.A., B.Sc., F.C.S.

(1) AN INTERESTING SOIL PROBLEM.

Owing to the great variety of soils occurring in the Transvaal one frequently meets with peculiarities which, though puzzling to the average farmer, are quite capable of being understood by any one who has a knowledge of the chemistry of soils. One such case has recently come under our notice. The majority of our soils might be described as sandy soils or sandy loams, and the improvement of these can be best effected by ploughing in organic matter such as a leguminous crop grown for the purpose and by adding to the soil some form of phosphate and, in some cases, lime in addition. In the case of which I am about to write the soil was not of a sandy nature, was rich in organic matter and (for a Transvaal soil) also rich in phosphoric acid.

On the 9th of January we received from Mr. A. A. Struben, farm Nooitgedacht No. 242, near Machadodorp, some samples of soil for analysis. In his covering letter Mr. Struben wrote as follows:—"I am at a loss to understand what is wrong with this soil. I planted, some three months ago, mealies, Japanese millet, kaffir corn, velvet beans, and swede turnips, and none of these have grown more than a few inches, and are quite yellow. There has been no want of rain, as I don't think we have had one fine week at a stretch this season."

In a subsequent interview Mr. Struben informed me that the natural veld is quite luxuriant, the ground being covered with a close sward of fine grass, and that potatoes and certain trees grow quite well on the soil, of which there is a long belt running from the neighbourhood of Lydenburg south to the Orange River Colony.

The samples, which were taken from virgin ground, were three in number, one representing the top 6 inches, one from 6 inches to 12 inches, and a third from 12 inches to 18 inches. The surface soil was red in colour, the second 6 inches reddish-yellow, and the third 6 inches quite yellow.

From the symptoms of the crops and the appearance of the subsoil I at once suspected the presence of injurious ferrous (unoxidised iron) compounds, and an analysis showed them to be present in considerable quantity in the second 6 inches of the soil, and to a less extent in the third 6 inches.

This went far to explain all the circumstances. Shallow rooting grasses might quite well flourish in such a soil, as it is retentive of moisture, and the roots would not require to go down as far as the injurious compounds. Potatoes feed chiefly on the surface soil, and, besides, are not nearly so sensitive to ferrous compounds as most ordinary crops.

The presence of ferrous compounds is generally associated with the following conditions, namely:—

(1) Abundance of iron compounds.
(2) Abundance of organic matter.
(3) Deficiency in lime.

When the soils were analysed all these conditions were found to be present, as will be seen from the following analyses. For purposes of comparison I quote similar figures for the average of 100 typical Transvaal soils recently analysed in our laboratories.

	Nooitgedacht Soil. Top 6 inches.	Nooitgedacht Soil. 2nd 6 inches.	Average Transvaal Soil.
	Per cent.	Per cent.	Per cent.
Moisture	6·82	7·42	2·40
*Loss on Ignition (organic matter)	14·00	12·82	5·84
Insoluble matter (sand, etc.)	54·31	49·47	79·88
Oxide of Iron and Alumina	28·45	29·61	11·09
Lime	0·01	trace	0·24
Magnesia	0·24	0·11	0·15
Potash	0·48	0·54	0·19
Phosphoric Acid	0·13	0·13	0·055
	99·94	100·10	99·845
*Containing Nitrogen	0·307	0·220	0·114
"Available" Potash	0·0025	0·0022	0·0113
"Available" Phosphoric Acid	0·0061	3·0070	0·0069

It was not considered necessary to analyse the third 6 inches of soil.

The practical question arises: "How are these injurious compounds to be got rid of?" The remedy is twofold, and consists of liming and thorough cultivation, so as to bring about the change (by oxidation) of the injurious ferrous compounds into harmless or even beneficial ones. By adopting this treatment other good results would follow. The natural deficiency of lime in the soil would be made good, and the large stores of nitrogen, potash, and phosphoric acid in the soil would be rendered "available" to plants.

The alternative to this treatment is to be content with growing timber and shallow-rooted grasses and plants like potatoes.

As the result of a consultation, Mr. Struben agreed to carry out an experiment on these lines. To one piece of land he proposes to give a heavy dressing of lime, making good use of the plough and cultivator whenever opportunity arises. On another piece he intends to grow potatoes after applying a dressing of lime to the land. Even with constant cultivation it may take more than one season before the ferrous compounds are oxidised, but Mr. Struben is willing, if it is found necessary, to continue the treatment for a second year. By growing potatoes for a few years on the same land and ploughing a little deeper each year the complete removal of the injurious compounds should also be accomplished. The results of Mr. Struben's experiments will be watched with interest by farmers on the same class of land, and perhaps some other farmers may wish to repeat the experiment on their own farms.

(2) BATS' GUANO.

The deposits of bats' guano occurring in caves in various parts of the country are almost the only natural sources of manure we have. Analyses of various samples of such deposits have been published from time to time in the *Journal*, and attention has been called to their great variability in composition, and therefore in value. Four samples from a recently discovered cave near Hennops River were recently secured for analysis, and, though showing considerable differences, they are amongst the best we have ever analysed. The following table shows the percentage of manurial ingredients present in the air-dry guano:—

	No. 1. Per cent	No. 2. Per cent.	No. 3. Per cent.	No. 4. Per cent.
Nitrogen	3·67	1·40	6·1	7·36
Lime	2·80	2·96	2·9	0·80
Potash	1·99	2·09	3·1	2·04
Phosphoric Acid	7·20	6·02	6·2	6·00

The two best samples were Nos. 3 and 4, which were fairly fresh deposits of pure guano.

The value of the various samples as compared with the price of ordinary artificial manures is approximately as follows:—

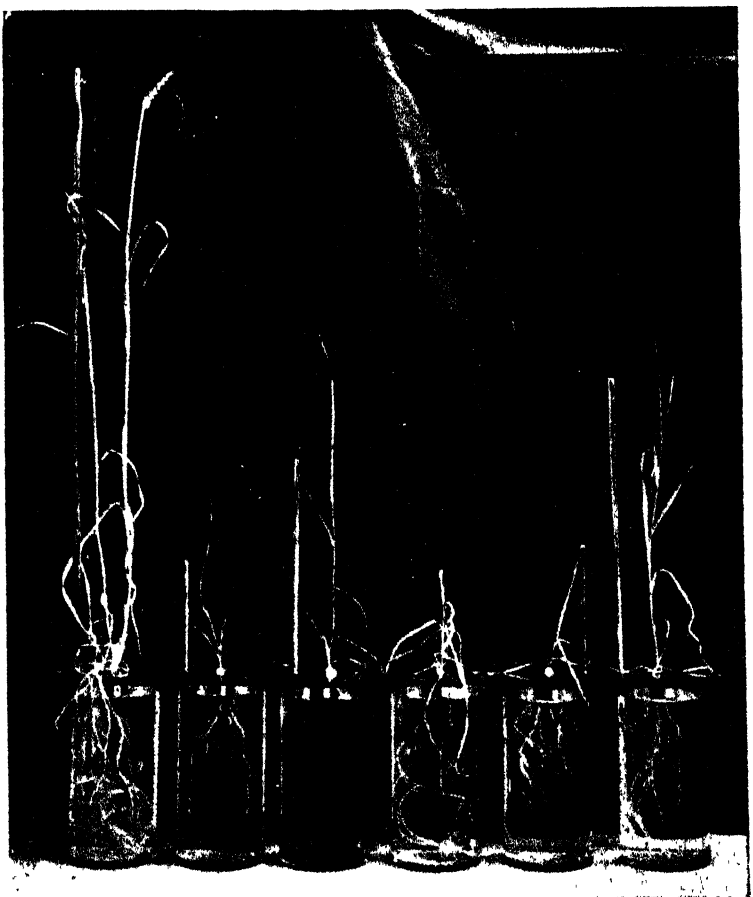
No. 1—£4 8s. per ton of 2,000 lbs.
No. 2—£2 18s. per ton of 2,000 lbs.
No. 3—£5 19s. per ton of 2,000 lbs.
No. 4—£6 4s. per ton of 2,000 lbs.

If guano like samples 3 and 4 were put on the market it would prove a very useful manure for growers of flowers, fruits, and vegetables.

(3) LIMESTONE.

Owing to the increasing demand for good white lime for the Witwatersrand mines greater attention is being paid to our limestone strata and also to the burning of the stone. The result is that a large quantity of white lime of good quality is being produced. Now white lime is better suited than blue lime for agricultural purposes, and though the demand for it on the mines is ensuring a plentiful output it is also helping to keep up the price. Some samples of limestone submitted to us for analysis have proved to be very good, one from the neighbourhood of the caves at Hennops River consisting of practically pure carbonate of lime.

A sample from the neighbourhood of Mitloop Siding, Potgietersrust, contained 85.7 per cent. of carbonate of lime, while another from the Potgietersrust town lands contained 89.2 per cent.



1 2 3 4 5 6

Plate 64

Water Cultures of Barley.

1. Complete "food" solution.
2. No nitrogen.
3. No phosphoric acid.
4. No potash.
5. No lime.
6. No magnesia.

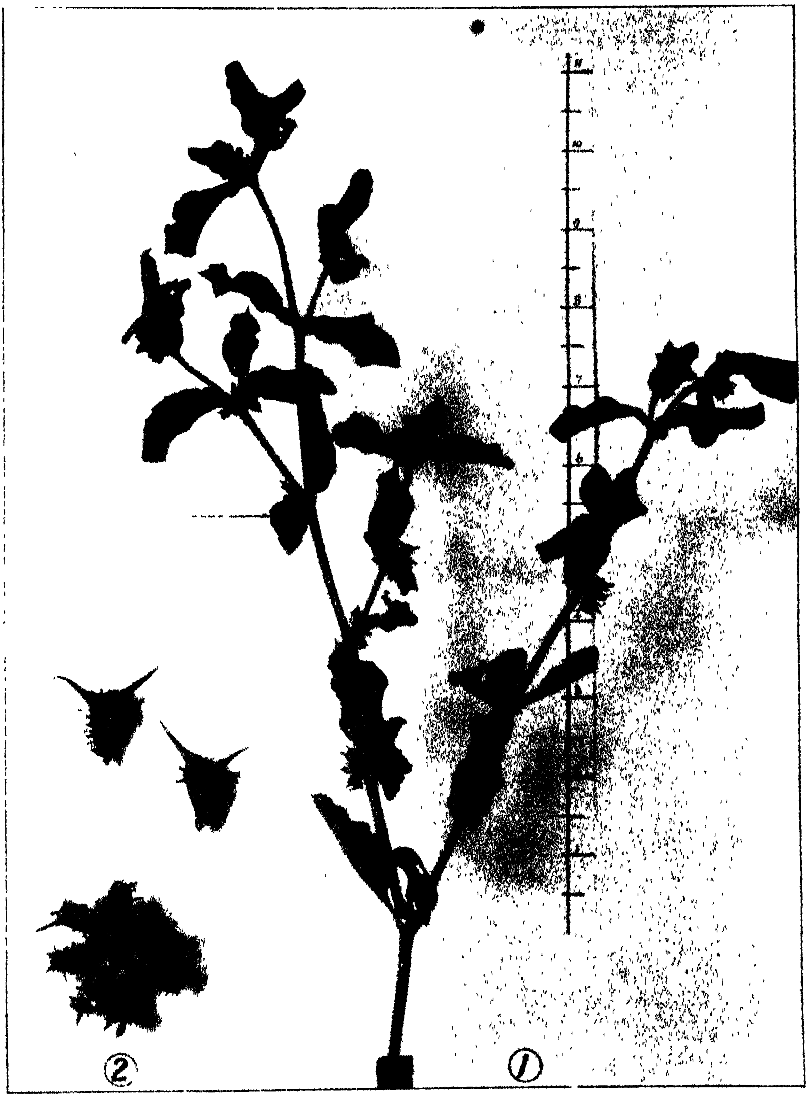


Plate 65.

A New Noxious Weed.

(*Acanthospermum xanthioides* DC.)

The Botanical Section.

I. CLIMATIC REQUIREMENTS OF THE MAIZE CROP.

By Joseph Burtt-Davy, F.L.S., Government Agrostologist and Botanist.

Maize is a tropical plant, susceptible to frost in all stages of growth, but, being an annual, it can be grown as a summer grain crop in warm-temperate climates; and, as a fodder crop (not maturing grain), even in the cool-temperate climate of the South of England. An investigation made in 1879 showed that 88 per cent. of the American crop of that year was grown between July Isotherms 70 and 80 degrees Fahr.

Altitude.

Harshberger brought together evidence which indicates that the maize plant was originally a native of tropical tablelands at a considerable altitude, probably above 4,500 feet.

Increase in altitude is accompanied by decrease in temperature and a shortening of the summer season, until, at very high altitudes, alpine conditions prevail; long before this point has been reached, however, it has ceased to be possible to produce maize. The shortening of the season with increasing altitude has an immediate effect upon the crop, in that the earliest autumn frosts, not falling regularly at the same date, are apt to kill the plants before the grain is ripe for harvest. The range of altitude between which a maize crop can be grown successfully will depend on the latitude. The nearer we approach the Equator the higher the altitude, within certain limits; and the converse also applies that the farther from the Equator the lower the altitude. Near Lake Titicaca, Peru, at about the 16th degree of N. latitude maize is grown successfully at 12,500 feet. Humboldt records vast maize fields on the Mexican plateau (between the 15th and 30th parallels) at 8,680 feet. In the Punjab, India, between the 30th and 35th parallels, it is more extensively grown in the hill country at 7,000 feet and over than in the valleys, where it is largely replaced by rice. In the United States the major part of the crop is grown between the 35th and 45th parallels, and 82 per cent. of it at an altitude between 500 and 1,500 feet; the proportion grown above 1,500 feet is only 4.4 per cent. Harshberger points out, however, that this is partly due to the absence of large areas of tillable land at an elevation of 2,000 feet, for very fine crops are raised in North Carolina at 4,000 feet, between the 34th and 37th parallels.

When more data have been accumulated, it may be possible to draw up a table showing the altitudinal limits of the maize crop at various parallels of latitude. But altitude only affects the growth of crops indirectly, as it influences length of season, temperature, precipitation of moisture, depth and richness of soil, etc.

TEMPERATURE.

It is frequently stated in the Transvaal that the lower bushveld (below 2,000 feet), though hotter, cannot compete with the high veld in the production of maize. This is partly due to the character of the soil, there being a narrow strip of poor soil running through the lower bushveld from north to south. Very good maize crops are raised on either side of this belt, at the same altitude. It is also partly due to deficiency or irregularity in the rainfall.

In the coast region of Natal the maize crops give a higher average yield per acre than on the uplands. This is probably due to increase in fertility of the soil, and to the longer growing season, than to actual increase in temperature.

It seems to be generally believed, outside of South Africa, that the maize crop does not flourish where the nights are "cool," no matter how favourable the other conditions. The term "cool" is not defined in this case, and seems to be rather misleading, for the maize crop certainly thrives in the Transvaal, though the summer nights are invariably cool. The Director of the Meteorological Department has kindly furnished the following temperature figures for Bethal and Vereeniging, two of the most important maize centres of the Transvaal, together with the mean daily temperature at 6 a.m. at the Government Observatory, Johannesburg, showing the coolness of the nights.

VEREENIGING.

September, 1904—*March*, 1908.

MONTH.	MEAN DAILY MINIMUM TEMPERATURE.				MEAN FOUR SEASONS.	AVERAGE.				MEAN FOUR SEASONS.
	04-05.	05-06.	06-07.	07-08.		04 05.	05-06.	06-07.	07-08.	
September ..	43·4	45·3	44·2	43·6	44·1	59·7	61·8	61·4	59·6	60·6
October ..	50·7	51·0	49·3	50·0	50·2	65·5	68·2	62·6	64·6	65·2
November ..	55·6	55·8	53·9	52·3	54·4	69·7	68·9	66·8	66·4	68·0
December ..	53·3	58·6	54·4	56·7	55·8	65·9	71·1	68·6	68·8	68·6
January .	57·2	61·0	59·0	55·1	58·1	70·1	74·1*	69·8	70·0	71·0
February ..	58·3	56·7	58·5	59·5	58·2	69·4	68·6	69·0	73·8	70·2
March	52·9	52·5	54·5	52·6	53·1	65·6	65·6	68·0	66·6	66·4
7 Months mean	53·0	54·4	53·4	52·8	53·5	66·5	68·3	66·6	67·1	67·1
Annual mean ..	45·2	45·6	45·2	44·0	45·0	60·6	61·4	60·3	60·5	60·7

* The actual largest maize yields in the United States have been grown between July Isotherms 75° and 80° Fahr.

BETHAL.

September, 1905—*March*, 1908.

MONTH.	MEAN DAILY MINIMUM TEMPERATURE.				MEAN THREE SEASONS.	AVERAGE.				MEAN THREE SEASONS.
	04–05.	05–06.	06–07.	07–08.		04–05.	05–06.	06–07.	07–08	
September ..	—	41 ·1	42 ·3	42 ·5	42 ·0	—	58 ·3	58 ·4	57 ·4	58 ·0
October ..	—	47 ·7	47 ·0	46 ·4	47 ·0	—	65 ·1	58 ·5	59 ·8	61 ·1
November ..	—	51 ·4	50 ·3	50 ·2	50 ·6	—	63 ·3	61 ·6	62 ·3	62 ·4
December ..	—	54 ·8	53 ·0	53 ·6	53 ·8	—	66 ·4	64 ·2	64 ·7	65 ·1
January ..	—	57 ·4	56 ·7	54 ·6	56 ·2	—	69 ·8	66 ·1	67 ·0	67 ·6
February ..	—	53 ·2	55 ·7	53 ·8	54 ·2	—	64 ·6	65 ·8	66 ·4	65 ·6
March	—	49 ·2	52 ·5	50 ·5	50 ·7	—	61 ·2	65 ·0	62 ·9	63 ·0
7 Months mean		50 ·7	51 ·1	50 ·2	50 ·6	—	64 ·1	62 ·3	62 ·9	63 ·2
Annual mean ..		43 ·0	43 ·8	43 ·1	43 ·6	—	58 ·6	57 ·3	57 ·5	57 ·8

GOVERNMENT OBSERVATORY, JOHANNESBURG.

September, 1904—*March*, 1909.

MONTH.	MEAN DAILY MINIMUM TEMPERATURE. 6 A.M.					MEAN, FOUR OR FIVE SEASONS. SEPTEMBER, 1904—DECEMBER, 1908.
	04–05.	05–06.	06–07.	07–08.	08–09.	
September ..	45 ·8	48 ·8	49 ·8	48 ·8	53 ·2	49 ·3
October	51 ·9	54 ·9	51 ·1	51 ·1	51 ·7	52 ·1
November.. ..	57 ·4	54 ·5	53 ·0	54 ·2	55 ·6	54 ·9
December ..	54 ·2	57 ·5	55 ·2	55 ·9	57 ·8	56 ·1
January	56 ·8	59 ·8	57 ·6	56 ·4	—	57 ·6
February	56 ·6	56 ·1	57 ·8	57 ·7	—	57 ·0
March .. .	53 ·5	53 ·5	56 ·6	54 ·1	—	54 ·4
7 Months mean ..	53 ·7	55 ·0	54 ·4	54 ·0	—	54 ·5
Annual mean ..	50 ·5*	51 ·4	50 ·5	50 ·7	—	—

* *N.B.*—The Director of the Meteorological Department points out that the mean daily minimum is 1 ·7° lower than the mean temperature at 6 a.m.

EFFECT OF EARLY FROST.

On the high plateau of the Transvaal, at 5,000 to 6,000 feet elevation, the season is usually too short for late-maturing breeds of maize, and almost every year a proportion of the crop of medium-late varieties—such as Hickory King—is seriously injured. This injury is due to a sudden fall of temperature which often precedes the advent of the real winter by two or three weeks, the frost being sufficiently severe to injure the unripe grain. A remedy can be found in autumn tillage and earlier planting to bring the grain sufficiently forward to miss the frost. As there is considerable difference in the time required for the maturity of different breeds, the earlier-maturing sorts should be used at the higher altitudes; but as these yield somewhat less than the longer-growing sorts, farmers are reluctant to drop the latter, even though they entail greater risk.

At the lower altitudes, as along the coast of Natal, the Lebombo range in Swaziland, and the adjacent portion of the Transvaal, the season between frosts is so long that two successive crops of maize grain can be matured the same year.

Temperature appears to have no direct effect upon the yield of maize per acre, but it does influence the maturing of the grain, and often in this way affects the yield of marketable grain, especially at our higher altitudes.

Moisture Requirements of the Maize Plant.

Maize is, on the whole, a drought-resisting crop, but it requires a considerable amount of water at certain stages of growth. Some varieties suffer less from drought than others. King has found that in Wisconsin the maize plant abstracts from the surrounding soil 270 lbs. of water for each pound of dry matter grown, which is equal to a rainfall of 2.4 inches for each ton, or only about half the amount required (in America) by oats and clover.

In Illinois the growth of maize during one week in July has been found equal to 1,300 lbs. of dry matter per acre, which would require 1.5 inches of rainfall, according to King's investigations. The plant is apt to suffer if a drought occurs at a time of such rapid growth, unless the soil is in the best physical condition.

A rainfall of 13 inches during the five growing months produced in Illinois 1,792 lbs. (practically nine muids) of dry maize grain per acre. The following year, with 22.5 inches during the same period, the yield (without fertilizer) was 5,264 lbs. (over twenty-six muids) per acre. The mean temperature was more favourable the first season than the second. The results indicate that the increase of seventeen muids per acre was due to the additional 9.5 inches of rain, an average of 1.9 inches per month.

Rainfall.

If no direct relation appears to exist between actual temperature and yield per acre, rainfall, on the contrary, has a very direct bearing upon yield. In the maize belt of the States the most favourable condition during the growing season is found to be a series of comparatively heavy rains, at considerable intervals, with clear sunshiny weather between. The rainfall should equal about 11.75 inches to 12.25 inches in the three summer months corresponding to our December, January, and February; of this, 4.75 to 5.25 inches should fall in January, when the ears are growing most rapidly. The average rainfall for these three months for thirty-nine stations through the maize belt of South Africa is 11.92 inches, while the average for January is 4.35, or 4.60 if we omit the three driest localities which are really outside the maize belt. Heavy rainfalls and cloudy weather during the planting season (corresponding to our October and November) are in America found to decrease the yield. With us, a wet October and November prevent proper weeding and encourage early growth of weeds, which withdraw moisture and plant-food from the young maize plants, thereby reducing yield. Excess of moisture at any period of growth causes the plant to become unhealthy and turn yellow; this also results in reduction of yield.

According to Myrick, Argentine farmers find that the great drawback to maize culture lies in the unfavourable climatic conditions for drying-out the grain. The winter is a period of damp and frosty rather than dry-cold weather, making it difficult to dry out the grain into merchantable condition. This failure to dry-out makes it difficult and dangerous to handle or store Argentine maize, and the percentage of loss in cargoes during ocean voyage is very heavy. Even where the greatest possible care is exercised, the unfavourable climatic conditions will remain as a severe handicap.

The following table, kindly prepared by the Director of the Government Observatory, Johannesburg, shows that the summer rainfall conditions throughout the greater part of South Africa are eminently suited to maize production. Certain areas must be excepted, however, such as the Cape Peninsula and the adjacent region having chiefly winter rains; the areas of very low rainfall such as the Karroo; areas where there is a deficiency in the spring rains, or where the intervals between rains are too great; and the higher mountain ranges where, though the rainfall is ample, the growing season is too short.

Place.	Annual Rainfall. Inches.	Annual Rainfall. Days.	November. Inches.	November. Days.	December. Inches.	December. Days.	January. Inches.	January. Days.	February. Inches.	February. Days.	March. Inches.	March. Days.	Rainfall, Dec., Jan., Feb., 3 Months. Inches.	Rainfall, Dec., Jan., Feb., 3 Months. Days.	Rainfall, November to March, 5 Months. Inches.	Rainfall, November to March, 5 Months. Days.	Period of Records. Seasons.	Period of Records. No.	Authority.
Transvaal:																			
Pretoria, Government Buildings..	25·32	82	4·15	12	3·90	13	5·49	14	3·91	10	3·16	11	13·30	38	20·61	61	1892-1908	17-18	Trans. Met. Dept.
Witwatersrand, Joubert Park ..	30·77	87	4·43	12	4·69	14	5·01	14	5·00	11	4·12	11	15·71	39	24·26	62	1888-1908	20-21	,,
Bethal (Dist.) ..	25·38	79	4·69	13	3·66	11	5·24	15	4·29	11	2·70	7	13·19	37	20·58	57	1904-5 to	3	,,
Bloemhof (Dist.) ..	19·03	63	2·48	8	2·11	7	3·74	11	3·14	9	3·40	9	8·99	27	14·87	43	1906-7	,,	,,
Ermelo (Eastern)..	37·26	100	8·17	17	5·83	14	5·61	14	3·59	14	3·83	11	18·03	42	30·03	70	,,	,,	,,
Heidelberg (Dist.)	25·47	73	5·03	11	3·42	10	4·49	12	5·25	11	2·68	8	13·16	33	20·90	53	,,	,,	,,
Lichtenburg (Dist.)	19 73	66	2·20	7	2·57	9	4·41	14	3 97	10	2·56	9	19·95	32	15·71	49	,,	,,	,,
Potchefstroom (Dist.)	23·24	69	3·42	9	3·36	9	4·76	12	4·24	10	2·69	9	12·36	32	18·47	49	,,	,,	,,
Standerton (Dist.)	26·54	75	5·00	11	4·34	11	4·48	12	5·30	12	2 33	8	14·12	35	21·45	54	,,	,,	,,
Waterberg (Dist.)	23·84	57	2·79	8	4·37	9	5·12	11	5·00	10	2·57	7	14·49	30	19·85	45	,,	,,	,,
Zoutpansberg (Town of Pietersburg)..	20·20	59	1·87	8	4·39	10	3·43	9	4·30	10	2·94	9	12·12	29	16·93	46	1904–07	,,	,,
Portuguese East Africa:																			
Lourenco Marques	27·27	66	3·50	9	3·73	8	5·03	8	5·21	7	2·78	7	15·00	23	21·28	40	1876-8,-91 1901–3–7	16	,,
Rhodesia:																			
Bulawayo	—	—	4·62	6·2	5·04	12	5·67	1·6	3·00	15·9	2 41	12·1	13·71	30·5	20·74	57·8	1897-8 to	10	Rev. Father
Salisbury	—	—	3·80	11·5	5·46	14·7	7 22	17·9	8·59	17·5	5·01	14·0	21·27	39·1	39·16	75·6	1906-7		Goetz, S. J.
Orange River Col.:																			
Harrismith ..	27·62	68	4·23	9	3·58	9	3·98	10	3·30	8	3·34	8	10·84	27	18·41	35	1882-1908 (breaks)	12-13	Trans. Met. Dept.
Kroonstad ..	25·18	—	3·46	—	2·83	—	4·73	—	3·56	—	3·75	—	11·12	—	18·33	—	1880–01	22	Sutton (Tr. S.A.P.S., XV).
Bloemfontein ..	23·37	—	2·22	—	2·86	—	3·81	—	3·68	—	3·67	—	10·35	—	16·24	—	,,	20	,,

BASUTOLAND:																			
Maseru	31·88	—	3·53	—	3·36	—	5·75	—	4·38	—	4·85	—	13·49	—	21·87	—	1891–01	11	Sutton (Tr. S.A.P.S., XV).
NATAL:																			
Newcastle ..	36·28	63	4·22	8	5·74	10	6·36	10	6·11	9	5·29	10	18·21	29	27·72	47	1894–9, 1901–7	13	Natal Obser., per Trans.
Dundee	29·61	71	3·52	10	4·09	10	6·53	12	5·18	9	3·48	8	15·80	31	22·89	49	1896–9, 1902–7	9 or 10	Met. Dept.
Weenen	25·83	76	3·45	10	3·55	11	5·34	12	4·11	9	2·89	11	13·00	32	19·34	53	1897-1907	10	,,
Estcourt	28·39	69	3·04	8	4·69	11	5·52	11	4·94	10	3·64	10	15·15	32	21·83	50	1894-1907	14	,,
Maritzburg ..	31·84	—	5·68	—	4·48	—	4·23	—	5·20	—	4·08	—	13·91	—	23·67	—	1858–67	10	Mann, Brit. Ass. Rep.
Maritzburg ..	34·86	124	4·56	17	5·78	18	6·41	18	4·88	14	5·34	15	17·07	59	26·97	82	1895-1907	13	Natal Obser., per Trans. Met. Dept.
Durban	40·00	120	4·64	15	4·60	15	4·09	14	4·43	11	4·69	12	13·14	40	22·45	67	1883–5, 1887-1907	23–24	,,
CAPE COLONY:																			
Mafeking	24·56	58	2·71	7	3·71	9	5·50	9	3·83	9	4·32	4	13·04	27	18·07	43	1887–1905	18	Trans. Met. Dept.
Bedford	27·68	—	3·11	—	2·99	—	3·28	—	3·50	—	3·99	·	9·77	—	16·87	—	1880–1901	22	Sutton (Tr. S.A.P.S. XV).
Butterworth ..	30·36	—	4·36	—	2·84	—	3·59	—	3·47	—	3·44	—	9·90	—	17·70	—	1889–1894	5–6	Buchan.
East London ..	24·43	—	2·66	—	2·11	—	2·29	—	2·16	—	2·65	—	6·56	—	11·87	—	1880-1901	22	Sutton (Tr. S.A.P.S. XV).
Fort Beaufort ..	22·39	—	2·61	—	2·12	—	2·68	—	2·70	—	3·33	·	7·50	—	13·44	—	,,	,,	,,
Graaff Reinet ..	16·26	—	1·66	—	1·60	—	1·78	—	1·91	—	2·78	—	5·29	—	9·73	—	,,	,,	,,
Herschel	27·95	—	2·24	—	3·57	—	4·78	—	3·75	—	4·28	—	12·10	—	18·62	—	,,	19	,,
Humansdorp ..	25·79	—	2·65	—	1·95	—	1·72	—	1·58	—	2·37	—	5·25	—	10·27	—	,,	22	,,
Kingwilliamstown	24·79	—	29·2	—	2·54	—	2·39	—	2·97	—	2·91	—	7·90	—	13·73	—	,,	22	,,
Peddie	24·05	—	2·74	—	2·18	—	2·05	—	2·03	—	2·61	—	6·26	—	11·61	—	,,	21	,,
Queenstown ..	24·53	—	2·36	—	3·28	—	3·93	—	4·01	—	3·56	—	11·22	—	17·14	—	,,	22	,,
Oudtshoorn ..	9·44	—	0·65	—	0·46	—	0·68	—	0·83	—	0·99	—	1·97	—	3·61	—	,,	21	,,
Somerset East ..	26·22	—	2·78	—	3·03	—	3·30	—	3·34	—	3·49	—	9·67	—	15·94	—	,,	21	,,
Sterkstroom ..	22·50	—	2·27	—	3·20	—	3·28	—	3·64	—	3·51	—	10·12	—	15·90	—	,,	16	,,
AVERAGE ..	26·21	—	3·45	—	3·54	—	4·35	—	4·03	—	3·40	—	11·92	—	18·71	—	—	—	

II. NOTES ON DETERMINATIONS OF PLANTS OF ECONOMIC INTEREST.

By Joseph Burtt-Davy, F.L.S., and Miss S. M. Stent.

The following article on some of the more interesting determinations of economic plants made during the year 1907-08 was prepared for publication in the last annual report of the Department, but was excluded for lack of space. It does not, of course, include notes on all of the material for investigation received during the year.

Fodder Grasses (*Family Gramineæ*).

Agrostis gigantea, Gaud.—A European species of bent-grass not previously recorded from South Africa. Not usually considered of much value for feed. Lion's Glen, Amsterdam.

Agrostis lachnantha, Nees.—A native perennial species not previously recorded from the Transvaal. Lake Chrissie, Haaskraal (Potchefstroom), near Nylstroom, Irene (near Pretoria), Lydenburg, Stud Sheep Farm, Ermelo. "Only grows in very wet places; keeps very green during the winter, and makes a very early start."— J. B. Buchanan, Lion's Glen, Amsterdam.

Andropogon appendiculatus, Nees.—A valuable native hay-grass. Lake Chrissie.

Bromus Willdenowii, Kunth ("Rescue-grass").—One of our most promising introduced winter pasture grasses now abundantly naturalised in many parts of this Colony. Wakkerstroom District.

Chloris virgata, Schw. ("Sweet-grass," "Zoet-grass.").—"A good grass, much relished by stock, but sensitive to frost."— Rhodesia Ranching Co., Salisbury. A native grass excellent for hay if cut while young.

Dactyloctenium aegyptiacum, Willd.—"Relished by stock."— Rhodesia Ranching Co., Salisbury.

Eragrostis sp.—"A useful pasture grass."—Department of Agriculture, Bloemfontein.

Panicum brizanthum, Hochst.—"Relished by stock."—Rhodesia Ranching Co., Salisbury. This species occurs also in the Transvaal.

Panicum maximum, Jacq. ("Guinea-grass").—"A good grass, much relished by stock, but sensitive to frost."—Rhodesia Ranching Co., Salisbury. Also occurs in the lower bushveld of the Transvaal.

Panicum laevifolium, Hack., a "Sweet-grass" or "Old Lands-grass."—An excellent hay-grass, well liked by stock, but being an annual it requires resowing periodically. Also occurs as a weed on wettish maize-lands. Natal Spruit, Vereeniging, Val Station, Stud Farm, Standerton, etc.

Phalaris arundinacea, L. ("Reed canary-grass").—A good hay-grass, native to the eastern high veld, as well as to Europe and North America. Lake Chrissie. Also found at Vlakfontein No. 12, near Amersfoort, and on the Mooi River at Frederickstad.

Setaria nigrirostris, Dur. and Schinz.—An excellent vlei-land pasture grass, thriving well on newly-broken veld. Tzaneen, Zoutpansberg, and Irene (near Pretoria).

Other Economic Plants.

Ipomoea albivenia, Sweet, family Convolvulaceæ ("Wild Cotton").—A stout creeper of the "Morning Glory" family. Seeds surrounded by a fibre resembling cotton, but the lint having no twist is worthless commercially. Spelonken, Zoutpansberg, Waterberg.

Cyperus usitatus, Burch., family Cyperaceæ ("Uintjes").—Pounded and boiled in milk and used as food by the Bechuanas near Kimberley.

Mariscus capensis, Schrad., family Cyperaceæ ("Monkey uintjes").—Used as food in the same way as *Cyperus usitatus* by natives near Kimberley.

Amarantus hybridus, L., family Amarantaceæ ("M'buya").—Used as a spinach, and eaten as a relish with mealies, kaffir corn, etc., by natives near Kimberley.

Gynandropsis pentaphylla, D.C., family Capparidaceæ.—"Leaves picked and dried during summer for use in winter as a vegetable" by natives near Kimberley.

Voandzeia subterranea, Thou., family Leguminosæ, "Bambarra ground-nut," "Ground bean," "N'dluba" (Tebel).—Eaten as food by natives; cultivated near Kimberley in the same way as pea-nuts.

Catha edulis, Forsk., family Celastraceæ ("Spelonken tea").—Said to be used as a beverage in the Spelonken.

Anacampseros ustulata, E. Mey, family Portulacaceæ.—Used in Cape Colony in the making of a kaffir beer.

Aeschynomene micrantha, D.C., family Leguminosæ.—"Ostriches like it."—Telunduteka, Upper Sand River, near Pilgrims Rest.

Trichilia emetica, Vahl., family Meliaceæ ("Maawa").—The seeds of this tree give an oil which has a fairly good commercial value. The Imperial Institute in reporting on it says: "An offer of £9 5s. a ton has been made for the seeds in this country, and a large trade could probably be done if the seeds could be regularly supplied in sufficient quantities." Eastern Zoutpansberg.

Mesembrianthemum acutipetalum, N. E. Brown, family Aizoaceæ.—A plant used by the natives in the preparation of the beverage Khadi: common to the south of Johannesburg, at Turffontein.

Mesembrianthemum (intonsin?), family Aizoaceæ.—One of the ingredients used near Port Elizabeth in the making of a kaffir beer.

Kæmpferia sp., family Zingiberaceæ ("Sherungulu").—A small plant bearing a beautiful mauve flower, and having strongly-scented tubers not unlike orris root: these tubers, or pieces of them, are eagerly bought by natives who use them medicinally or wear them as charms. Investigations are in progress as to the plant's commercial value as a perfume. It grows on mountain-sides of the Drakensberg in tropical and sub-tropical Transvaal, from the Groot Spelonken south to the Barberton District.

Hypoxis sp., family Amaryllidaceæ.—Possible fibre plant, but apparently without commercial value. East Rand.

Anthericum angulicaule, Baker, family Liliaceæ.—Possible fibre plant, but apparently without commercial value. East Rand.

Malva parviflora, L., family Malvaceæ ("Kissie blaar").—"This is a very valuable fodder plant for small stock as it makes good growth during the winter months, and it is only then that sheep and goats eat it. Frost has no effect on it."—S. J. Hyde, Uitkyk, Leeuwdoorns, Wolmaransstad District. We have noticed at Skinner's Court that the kissie blaar stood the winter well, but doubt whether it will be as useful as sheeps burnet, rescue-grass, and tall fescue, which withstand drought and frost well, are more nutritious, and yield a larger amount of fodder.—J.B.-D.

Veronica Anagallis, L., family Scrophulariaceæ.—The plant grows on the sandy bottom and sides ot the Mooi River. It is the most important green thing in the river during the later winter months, and forms a fine harbourage for *Gammorus pulex*, the finest fish food known. I would strongly recommend its introduction to all waters containing trout."—C. Harvey, the Trout Hatchery, Potchefstroom.

Melilotus indica, All., family Leguminosæ.—From Johannesburg. This is an alien plant frequently sent for determination and information. It has small yellow flowers and a strong scent to the foliage, and is frequently found amongst lucerne. It is of no use as a fodder plant, its bitter flavour, due to the presence of coumarin, deters stock from eating it. As a green-manure plant it is useful, its roots bearing in abundance the nitrogen-containing nodules.—J. B.-D.

Vernonia Kraussii, Sch. Bip., family Compositæ.—"Supposed to be a cure for dysentery." East Rand, Krugers Post, Lydenburg, etc.

Chenopodium Botrys, L., family Chenopodiaceæ.—Wolmaransstad District. An alien plant naturalised and spreading over the Transvaal, and commonly known as "Jerusalem Oak." Said to have been used with a fair amount of success for gall-sickness. This plant possesses anthelmintic properties, and is also said to have been used in France, with advantage, in cases of catarrh and asthma.—J. B.-D.

Chironia baccifera, L., family Gentianaceæ.—In Cape Colony it is "supposed to contain strong medicinal qualities."

Monechma divaricatus, C. B. Clark, family Acanthaceæ, "Wild Lucerne."—An important native winter pasture plant near Kuruman, Bechuanaland.

Psoralea obtusifolia, D.C., family Leguminosæ ("Wild Dagga").—An important native winter pasture plant near Kuruman, Bechuanaland.

Phalaris canariensis, L., family Gramineæ ("Canary-grass").—Lake Chrissie. An annual alien grass of some use for hay and pasturage, but mainly valued as a bird-seed.

Plants known or Reported to be Poisonous.

Pachystigma Zeyheri, Sond., family Rubiaceæ.—Suspected of stock-poisoning near Klerksdorp. This is a small, low-growing plant very closely resembling the common "gift-blaar," and is frequently sent to us as the cause of poisoning. So far all tests have yielded negative results, and it is probable that in most instances it is a case

of mistaken identity. The two plants are often to be found growing together and are easily mistaken for each other.—J. B.-D.

Trifolium africanum, Ser., family Leguminosæ ("Klaver").—Suspected of poisoning cattle at Brakfontein near Amersfoort. It is unlikely that the clover has any poisonous qualities; it might be injurious to cattle if eaten green in too great quantity, causing hoven or opblaas in the same way that lucerne does.—J. B.-D.

Mentha sp., *Gnaphalium luteo-album*, L., *Cyperus* sp., *Erigeron canadense*, L., *Vicia sativa*, L., *Polygonum lapathifolium*, L.—Found in Pretoria forage which is suspected of causing colic amongst mules. None of these plants is likely to have caused the trouble.—J. B.-D.

Solanum nigrum, L., family Solanaceæ.—"Suspected to have been the cause of the death of two children near Johannesburg." It is reported poisonous at different stages of growth, especially the green fruits, but the fruit when ripe is edible and innocuous.—J. B.-D.

Senecio latifolius, D.C., family Compositæ.—From Standerton. One of the poisonous plants of the Transvaal. We have also had specimens sent to us for determination from Umtali, Rhodesia, where it is reported to have caused the death of cattle.

Jatropha Curcas, L., family Euphorbiaceæ (the "Physic-nut"). —The family Euphorbiaceæ contains many poisonous species. The seeds of this particular one contain a poisonous oil with active principle similar to that of croton oil.

Geigeria passerinoides, Harv., family Compositæ.—A small, low-growing shrublet with yellow flowers and narrow leaves. This plant was previously reported to us as being poisonous in Bechuanaland. Mr. Peacock, of Holwater South, P.O. Britten, also sent in specimens of this plant, which he suspects of having caused abortion in sheep and goats. The same grows on the farm of Mr. Pringle, Elsendale, Christiana, who has lost a number of head of cattle through what he thinks to be poisoning.

So far the tests made under the direction of Dr. Theiler have given negative results, the sheep to which it was fed showing no effects; more material is needed for an extended test.

Anoiganthus breviflorus, Baker, family Amaryllidaceæ.—Said to be highly poisonous to stock in the Orange River Colony; also found in the Transvaal, near Bronkhorstspruit, where it is suspected of poisoning.

Abrus precatorius, L., family Leguminosæ ("Jequirity bean," "Crab's eyes").—A creeper growing in the Zoutpansberg with small red and black seeds. Bean very poisonous if powdered and applied subcutaneously.

Cucumis sp., family Cucurbitaceæ.—Suspected of being poisonous near Johannesburg.

Homeria pallida, Baker, family Iridaceæ (common "Yellow Tulp").—"Said to have caused the death of a calf" at Machadodorp.

Acalypha sp., family Euphorbiaceæ.—Supposed to have caused the death of a calf at Krugersdorp, but not known to be poisonous. Material insufficient for test.

Gnidia sp. (?), family Thymeleaceæ.—Root only sent; said to have caused human poisoning at Diepkloof Farm Prison.

Weeds.

Acanthospermum xanthioides, D.C., family Compositæ (Plate 65).—An alien weed from the West Indies and tropical South America (Venezuela and Guiana to Buenos Ayres); has been found by Miss Leendertz in Pretoria, and later by Mr. Weeber, the Burweed Inspector, at Wonderfontein No. 41 and Schietkraal No. 332, Marico District. As its specific name implies it bears some resemblance to a burweed in that it produces prickly burs which may prove troublesome to wool and mohair growers. Although it is a tropical species it is an annual, and may thus be able to establish itself on the high veld if it once gets there. Steps should be taken to eradicate it completely before it has a chance to spread far.

Aristida barbicollis, Trin. and Rupr., family Gramineæ.—A worthless annual veld weed of the Transvaal and Orange River Colony.

Aristida sp., family Gramineæ.—Lake Chrissie. A poor grass, not eaten by stock.

Blepharis (*linearifolius*?), family Acanthaceæ.—Material incomplete. A spiny, troublesome weed near Pietersburg. It has blue flowers enclosed within an involucre of greyish spiny bracts, and narrow leaves.

Centaurea melitensis, L., family Compositæ ("Malta Thistle").—Flowers bright yellow, in small thistle-like heads. A Mediterranean weed which has lately appeared in the Transvaal near Daspoort, Pretoria, and is likely to spread. Somewhat injurious to wool and mohair.

Cineraria lyrata, D.C., family Compositæ.—"It is said to give a very unpleasant flavour to butter if eaten by the cow."—Department of Agriculture, Bloemfontein. An indigenous species, so far not recorded from the Transvaal.

Eleusine indica, Gaertn., family Gramineæ ("Goose-grass").—Relished by stock in the Rustenburg District, but is usually an annual, and sensitive to frost. It is proving a troublesome weed in some districts, where it spreads rapidly on good soils, taking the place of better kinds.

Hordeum murinum, L., family Gramineæ ("Barley-grass").—Mr. A. B. Helm, M.L.A., writes: "Yesterday, at Wakkerstroom, I came across a specimen of a grass which, years ago, I found on Elandsfontein No. 346, which I rented at that time. At Elandsfontein it grew under the trees of the orchard, and spread also outside where it was moist. Is perfectly proof against the severest frost, even when the 'os-gras' (*Eragrostis plana*) was partly nipped. Stock do not like it in summer, but eat it greedily in winter. I can't tell whether it is a perennial or not, but, if not, then it must grow freely from the seed, which is ripe in January when the grass falls over: a new crop is about four inches high in May, like a 'brand.'" This grass is a native of the Mediterranean, and has become widely spread in warm and temperate countries; in California it has become a serious pest. At maturity the head (a spike) breaks up into short lengths, each of which is armed with a sharp point (the "callus") which penetrates the wool, hair, and even the skin of animals. These *calli* work up the nostrils of animals, into their eyes, sometimes through the skin, causing ulcers, and they have been known to

penetrate the brains of pigs, causing madness. Although somewhat useful in winter it is not a safe grass to have on a stock-farm, and should be cleared out before it becomes so well established that this cannot be done. When once established this grass spreads very rapidly wherever the climate suits it.—J. B.-D.

Lappula texana (Scheele) Britton, family Boraginaceæ.—Found among forage at Wolmaransstad; probably introduced with seed oats. This weed is new to South Africa; it is an American species known there as "hairy stickseed." It produces small nutlets ("seeds") bearing short, strong, barbed prickles; these nutlets when dry separate into burs that catch on the hair or wool of animals, and may become injurious to commercial wool and mohair; but though common and widespread in America it does not appear to have become a dangerous weed there.—J. B.-D.

Lolium temulentum, L., family Gramineæ ("Darnel," "Cheat," or "Drabok").—Godwan River, Barberton. "Among some seed oats we bought a great percentage has come up as per enclosed sample of grass. Will you kindly let us know what it is called, and whether it is of any value as a fodder crop?" This grass is too often found as an impurity in badly-cleaned samples of South African-grown seed oats, barley, and oats. It is useless as a fodder grass. The seeds, if taken in quantity, have been known to cause illness, and even the death, of stock.

Osteospermum muricatum, var. *asperum*, Harv., family Compositæ.—Waterberg.

Rumex acetosella, L., family Polygonaceæ ("Steenbok zuuring").—A very troublesome weed near Ladybrand, Orange River Colony. Proper winter fallowing of the ground after autumn ploughing has been found effective in getting rid of it in a couple of seasons.

Selago sp., family Scrophulariaceæ.—Said to be very plentiful on the veld of the Orange River Colony, but not eaten by stock.

Sorghum Halepense, Nees, family Gramineæ ("Johnson-grass").—A noxious weed found near Val Station, Standerton. Every precaution should be taken to eradicate it before it can become established, otherwise it is likely to prove too difficult a task.

Tagetes minuta, L., family Compositæ.—First reported to us as appearing in large quantities in the Wakkerstroom District, now found in Pretoria and elsewhere. It is a rank-growing shrublet with fern-like foliage and numerous small yellowish flowers, the whole plant having a strong scent. It is a native of South America, probably introduced into the Transvaal with forage, etc., as it was first noticed on the sites of old camps. In Australia this weed appeared in the same way. Although spreading rapidly it is not likely to become a very serious pest as it appears to be one of those quick-growing, free-seeding plants that soon "run themselves out."

TREES.

Native.

Acacia rehmanniana, Schinz. ("Engelsman's doorns"), family Leguminosæ.—Potgietersrust.

Albizzia sp., family Leguminosæ.—Below Pilgrims Rest. Material incomplete.

Callitris Cupressoides, Schrad., family Coniferæ ("Berg Cypress").—Found on the Blaauwberg, Zoutpansberg West, and also on the Wolkberg, Zoutpansberg East, at an elevation of 5,000-5,200 feet.

Combretum sp., family Combretaceæ ("True Hardekool").—Potgietersrust.

Combretum Zeyheri, Sond., Combretaceæ ("Wurm Kos").—"Wood tough but will not stand in ground; easily eaten by insects . . . partially deciduous." Waterberg.

Euclea multiflora, Hiern (?), family Ebenaceæ.—Moeple Pass, Waterberg District.

Gardenia Thunbergia, L.f., family Rubiaceæ.—Pretoria. Attacked by small beetles and by a scale-insect.

Heteropyxis natalensis, Harv., family Lythraceæ ("Lavandel"). Potgietersrust.

Lannea sp., family Anacardiaceæ ("N'dvata").—"A large tree with edible fruit"; probably a new and hitherto undescribed species. Tsama River, Zoutpansberg N.E.

Loranthus sp., family Loranthaceæ.—A parasite on trees, Potgietersrust.

Melianthus comosus, Vahl., family Melianthaceæ.—Castrel's Nek, Wakkerstroom.

Pavonia sp., family Malvaceæ.—"Plant on which certain cotton insect pests feed" near Lourenço Marques.

Pseudocedrela caudata, Sprague, family Meliaceæ.—Spelonken.

Pterocarpus sericeus, Bth., family Leguminosæ.—Potgietersrust.

Pterocelastrus sp., family Celastraceæ.—Lydenburg. Material too meagre.

Salix Wilmsii, Seem., family Salicaceæ.—Pistillate flowers only. A native species of willow from stream banks about nine miles from Pretoria.

Schotia sp., family Leguminosæ ("Turpentine-tree" or "Waterhout").—"The finest tree on the river. Evergreen." Limpopo River, N.W. Waterberg District.

Terminalia prunioides, Laws., Combretaceæ ("Hardekoolboom").—"Wood very hard and heavy; makes good charcoal." Limpopo River.

Vitex Rehmannii, Gürke, family Verbenaceæ ("Moqueli").—Megalakwin River, west of the Blaauwberg.

Cultivated Trees and Shrubs.

Brachychiton populneum, R.Br., family Sterculiaceæ.—An attractive tree; native of Australia. Often planted as a street tree in California. "Seeds obtained from Tasmania and planted on a farm between Rietfontein Station and Driefontein Siding, where they have done remarkably, making very attractive trees and withstanding drought and frost." At one time called *Sterculia diversifolia*.

Cunninghamia sinensis, R.Br., family Araucariaceæ.—Material incomplete. Native of China.

Eucalyptus sepulcralis, F. Muell (?), family Myrtaceæ.—A drooping gum; material incomplete.

Merremia sp., family Convolvulaceæ.—Shrub cultivated at Barberton.

Morus japonica, Audib., family Moraceæ ("Japanese Mulberry").—Cultivated in Pretoria.

Nyctanthes arbor-tristis, L., family Oleaceæ.—Cultivated in Barberton.

Pinus densiflora, Sieb. and Zucc., family Pinaceæ ("Japanese Red Pine").—Cultivated at Ermelo.

Pinus muricata, Don., family Pinaceæ ("Prickle-cone Pine").—Native of California. Cultivated at Ermelo.

Pinus Thunbergii, Parl., family Pinaceæ ("Japanese Black Pine").—Cultivated at Ermelo.

Sapindus sp., family Sapindaceæ.—Tree growing in Pretoria. Pistillate flowers needed for specific determination.

We are indebted to Dr. Harry Bolus, F.L.S., and to Dr. S. Schönland, F.L.S., for valuable assistance in the determination of certain critical species.

III. MAIZE SMUT OR "BRAND."

[*Ustilago Maydis* (D.C.), Corda.]

By I. B. Pole Evans, B.A., B.Sc., F.L.S., Plant Pathologist.

Smut or "brand" in the maize crop is a phenomenon so familiar to almost every farmer throughout South Africa that some growers look upon it as part and parcel of the plant, and do not realise that it is a disease caused through the agency of a foreign organism. The organism is a microscopic plant known as a fungus. A knowledge of its life history, its mode of existence, and its relation to its host will be found useful to those who wish to keep it under control. This microscopic plant lives as a parasite within the tissues of the maize, and is only seen by the ordinary observer when it breaks out on the surface of the invaded parts as a black, dusty mass. The black powder or smut consists of myriads of microscopic reproductive bodies, commonly known as spores. They serve to propagate the fungus and disseminate the disease, and correspond in function to seeds in the higher plants. Each spore is brown and spherical, and measures about one thirty-three hundredths of an inch in diameter. Under favourable conditions these spores germinate, and give rise to a number of secondary bodies which are blown about by the wind, and then infect the maize plant. (See Plate 66.)

It is found that the spores germinate more readily, and also give rise to a larger number of secondary bodies, in fresh stable manure than in ordinary soil. Consequently, if a heavy dressing of fresh stable manure is applied to land infested with smut spores just before planting, the risk of infection will be much greater to plants growing in such ground, inasmuch as more secondary bodies will be produced than would have occurred in untreated land.

As the secondary spores are able to infect all young and tender parts of the maize plant, their presence in the maize lands should be prevented as far as possible. This can best be done by removing and burning all smutted plants by using seed free from smut spores and by avoiding the use of fresh stable manure at the time of sowing.

IV. PEACH FRECKLE OR BLACK SPOT.

(*Cladosporium carpophilum*, Thuem.)

By I. B. Pole Evans, B.A., B.Sc., F.L.S., Plant Pathologist.

Many fruit growers during the past season were troubled with an unusual spotting and discolouring of their peaches and nectarines. Peaches in particular were so checked in growth that they failed to ripen normally, and eventually suffered much cracking. (See Plate 67.)

This condition of affairs is brought about by the action of a fungus parasite, which causes the disease commonly known as freckle, black spot, or scab. The fungus was first described in 1877 by a German botanist, who found it causing considerable damage to peaches at Klosterneuburg, near Vienna, in Austria. Some twelve years later it was to be found in nearly all the peach-growing districts of the United States and California. To-day it is frequent on peaches throughout South Africa.

The disease may affect the apricot, almond, cherry, nectarine, peach, and plum. As it most commonly occurs on the peach in this country, its characteristic appearance on this fruit will only be given here.

It first appears in the form of small, round, and dark green spots, usually at the stalk end of the fruit. These spots quickly increase in numbers, and extend their range of growth towards the apical portion of the peach. They are nearly always much more abundant on one side of the fruit than the other, and the side most exposed to the sun is the worst affected as a rule. The spots usually coalesce and produce dark coloured patches. The parts of the fruit attacked by the fungus become hardened and tough, and not infrequently the side affected shrivels considerably. If any further growth of the peach takes place after the skin has become hardened by the action of the fungus, a characteristic cracking of the fruit occurs which greatly impairs its keeping capabilities, in that it renders it an easy prey to decay fungi.

The most effective treatment for this spot disease is winter spraying. About three weeks before the buds begin to burst, the tree should be thoroughly sprayed with "Bordeaux mixture." The best formula to adopt will be that recommended for peach leaf-curl, viz., 5 lbs. copper sulphate, 5 lbs. of lime, and 45 gallons of water.

The mixture should be made up as follows:—Place the 5 lbs. of copper sulphate, after crushing, in a 45 to 50 gallon cask and dissolve in 10 gallons of water. Then, in another cask, slake 5 lbs. quicklime, which should be of the best quality, and add 10 to 12 gallons of water. Strain the milk of lime into the copper solution, stir well, and add sufficient water to make up 45 gallons. When cool, the mixture is ready for use. Two more sprayings will probably be found necessary to give the best results. These should be carried out just after the fruit has set, and again when it is about half-grown.

The "Bordeaux mixture" formula for these two latter sprayings should be:—6 lbs. copper sulphate, 4 lbs. lime, and 100 gallons water, otherwise the foliage is likely to suffer injury from the spray used.

Plate 66.

Maize-Smut or Brand.

[*Ustilago maydis* (DC.) Corda.]

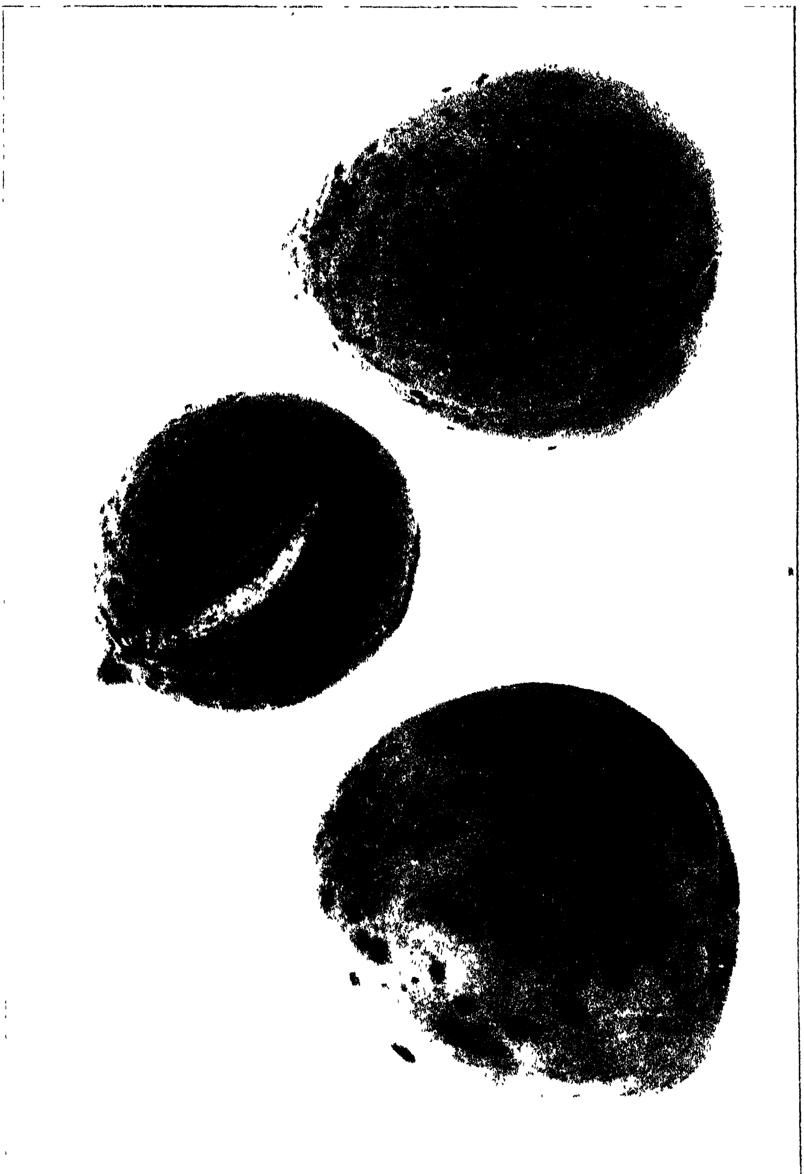


Plate 67

Peach Freckle or Black Spot.

(*Cladosporium carpophilum*, Thüm.)

V. NOTES ON CO-OPERATIVE EXPERIMENTS.

By H. Godfrey Mundy, P.A.S.I., Assistant for Field Experiments.

The system of co-operative experiments was initiated by the Transvaal Department of Agriculture in 1904, and having been continued uninterruptedly up to the present date, it is now possible to draw some fairly accurate conclusions from the results which have been obtained. All of the more important crops such as lucerne and other leguminous plants, maize, millets, and the various winter pasture-grasses have been tested each year throughout the whole period; thus the conclusions are not based on the results of one trial only but on those of a number of seasons, each of which has been marked by some peculiar condition as, for instance, the droughty year of 1904-05; the severe insect attacks, hailstorms, and spring drought of 1905-06; the plentiful, and in some cases excessive, rainfall of 1906-07, followed by an almost unprecedented plague of locusts; and, finally, the extreme summer drought followed by the early frost of last autumn. Seasons such as these are fairly typical of the vagaries of our climate, and the results may therefore be taken as thoroughly representative.

The drawbacks and disadvantages which have had to be contended with are considerable, and a no small proportion of the experiments has resulted in entire failure owing to drought, hail, early frosts, excessive rains, parasitic fungi, locusts, cut-worms, and other pests. Another detrimental factor has been the lack, on the part of many farmers, of knowledge of the habits and requirements of the crops which they were endeavouring to grow. This is a trouble which experience alone can remedy, and each year it becomes less noticeable.

Among the advantages derived from a system of co-operative experiments are the following:—

(1) Introduction of new crops or new varieties into the country.

(2) Supplying the farmers with the initial means of growing their own seed.

(3) Stimulation of agricultural development. A man who has grown half an acre of lucerne successfully is thereby encouraged to plant five acres; an earlier maturing or heavier yielding variety of maize may double the production of a district.

(4) The educational value to the growers, making them better acquainted with the various needs of different crops, and often suggesting new methods of cultivation and, perhaps, new lines for experiment.

(5) The information which the Department gains regarding the suitability or otherwise of different crops to the various conditions of soil and climate found in the Transvaal.

During the years 1903-05 co-operative experiments were still in the initial stage, and it was not until the end of 1905 that they attained anything like full development. Since that date they have

steadily increased, until last season when they were participated in by over 700 farmers holding land in all parts of the Transvaal.

In dealing with each crop in detail, I have endeavoured first to indicate the general conclusions which may be drawn from the experiments, and have then quoted, verbatim, a few typical reports in support of these conclusions.

Dry-Land Lucerne (*Medicago sativa*).

All the best-known varieties of lucerne have been tested, including the following: Cape (Oudtshoorn), Hardy (European), Hunter River (Australian), Provence (French), Poitou (French), Swiss, Tamworth (Australia), and Turkestan (from Central Asia). Several hundred experiments have been conducted in all parts of the Transvaal, and the lessons learned thereby are of great value. The results have given emphasis to the following points:—

(1) That given suitable soil and proper attention, good stands can be established.

(2) That the selection of a suitable site and careful preliminary treatment of the soil go a long way towards ensuring success.

(3) That in ordinary seasons dry-land lucerne which is well established will give a considerable amount of very valuable grazing, but does not usually grow sufficiently luxuriantly to be cut for hay.

(4) That weeds are among the worst enemies of dry-land lucerne, and that in order to guard against these clean land should be selected in the first place; and, secondly, seed should be drilled and not sown broadcast.

(5) We cannot yet state how long stands of dry-land lucerne will last in the Transvaal, but, under favourable conditions, we have personal evidence of satisfactory four and five-year-old stands.

(6) That dry-land lucerne usually does best on the lighter classes of soil, and is often difficult to establish on a "black turf" land.

(7) That there are certain soils on which it is useless to attempt to establish lucerne, e.g. water-logged land or soil of insufficient depth, but that on these, annual leguminous crops such as velvet beans, kaffir beans, etc., can often be profitably substituted.

(8) That the climate of the lower bushveld makes it difficult to establish dry-land lucerne, and that good stands are not often met with in the low country.

Of the varieties most suitable for dry-land cultivation the strain known as "Provence," from the south of France, is among the best, and has the advantage that seed can usually be obtained at a moderate price and guaranteed clean and free from dodder.

The following reports are typical of many which have been received:—

Variety "Cape."—Sown 25th January, 1906: suffered owing to late sowing, did well at first but later on killed by dry winds and locusts: not established in time.—Setterfield Bros., Bandolier Kop, Zoutpansberg East.

Sown 2nd December, 1906; grew well and is making a good stand.—R. W. Hammond, Islay, Amsterdam.

Did fairly well and should come up strong next spring. Sown broadcast; has given much trouble to keep clean.—R. E. Hazel, Verkyk, Wakkerstroom District, 1905-06.

Variety "Hardy."—Sown in *vlei* soil in September, October, and November; in each case begins to die off when about one month old; can obtain no stand at all.—A. Roscher, Ventersdorp, Potchefstroom District, 1905-06.

Germinated well and made good growth, then appeared to be checked by drought, but later on recovered and now has every appearance of making a good stand.—Durney & Gale, Middelrand, Duivelskloof, Zoutpansberg East, 1905-06.

Variety "Hunter River."—Sown 22nd January, 1908. Crop appears (10th May) a perfect success, 10 to 12 inches high.—A. E. Tandler, Tandlerville, Warmbaths, Waterberg District.

Sown 22nd November, 1907; 3rd March, 1908. Has done well in spite of drought and caterpillars, now (1st June) stands green in spite of frosts.—N. J. Meyer, Wintershoek, Wakkerstroom District.

Variety "Provence."—Quite a success, sown in December; four cuts obtained during summer; much troubled by weeds.—A. Roscher, Ventersdorp, Potchefstroom District, 1906-07.

Dry-land lucerne has been quite successful with me; I have a good stand established. Ants are very troublesome.—A. E. Grigson, Harborough, Bloemhof District, 1906-07.

Have tried lucerne for three years now (1905-06). This year it came up and then died off; a few scattered clumps still remain about six inches high, but do not look well.—J. M. Davey, Driefontein, Piet Retief.

Sown in February, 1906, now well established though some suffered from drought.—J. E. Dyer, Haaskraal, Potchefstroom District.

Grew well, but was eaten by caterpillars; coming up again well.—A. T. Tucker, Blindefontein No. 2299, Nylstroom, Waterberg District, 1906-07.

Six acres, sown 15th February, has done very well in spite of drought and I expect to get good grazing from it next spring. Reported 11th June.—G. J. Henderson, Doornkraal, Zoutpansberg District, 1907-08.

I am laying down eight acres with dry-land lucerne and burnet.—H. F. C. Johnston, De Hoop, Bloemhof District, 1907-08.

I have succeeded in establishing a good stand of dry-land lucerne; seed was sown in October, 1907. Reported 5th May. W. B. Coburn, Home Farm, Heidelberg District.

I sowed the lucerne on dry land; it has been quite a success and I intend to sow this crop more largely.—W. van Wyk, Devonpan, Potchefstroom District, 1907-08.

Lucerne sown in March; very little rain after sowing; have obtained a good stand (21st June) and am cutting it daily for pigs.—S. P. Blackmore, Plantation Farm, Barberton District. The writer personally inspected Mr. Blackmore's stand; it is about two acres in area and at that date was eminently satisfactory. The soil is a deep red loam. The seed was drilled on well prepared ground and the crop is extremely promising. Mr. Blackmore intends to sow more largely next year.

Sown 25th February, has made a good stand in spite of the drought—12th June. Establishing dry-land lucerne is only a matter of good cultivation and deep ploughing. (Given a suitable soil. H (G.M.)—C. Becker, Fortuna Station, Heidelberg District, 1907-08.

Variety "Swiss." Did very well and made a good stand; grazed down by cattle; promises well.—M. M. Beyers, Rietfontein, Bethal District, 1906-07.

Has done well on the whole and has made a really good stand in spite of being eaten down by locusts. C. H. Murray, Heidelberg, 1906-07.

Has done well and is most valuable for grazing with sheep.—A. P. Roos, Standerton District, 1906-07.

Variety "Tamworth."—Sown 1st February; all land well prepared; half of plot manured with kraal manure; has done fairly well (14th June); only 1½ inches rain since sowing. I feel convinced that kraal manure helps growth, but needs a lot of watching for weeds.—H. Lukey, Uplands, Potchefstroom District, 1907-08.

Variety "Turkestan."—I feel confident that lucerne can be grown on dry land as a summer crop.—S. W. Trollope, Hartebeesthoek, Pretoria District, 1905-06.

Did well, sown broadcast under buckwheat, but should have been drilled on clean land.—O. J. Griffen, Goede Hoop, Bethal District, 1906-07.

Failed owing to being sown on land which retained too much moisture.—J. C. Rous, Riverside, Middelburg District, 1906-07.

Dry-land lucerne in the Low Country round here has nowhere proved a success.—J. Kirk, Barberton District.

OTHER LEGUMINOUS CROPS FOR HAY, SILAGE, OR GREEN MANURE.

COWPEAS (*Vigna Catjang*).

Several varieties have been tested including the Black-eyed, the Whip o' Will, the Unknown, and the New Revenue. The crop has been repeatedly tried in all parts of the Transvaal, and has proved an excellent one for the high veld. It matures more quickly than the velvet bean, and on the high veld will yield more heavily. Its main uses are for hay, silage, or green manure, and being an annual leguminous crop it should prove most valuable for growing in rotation with maize, wheat, and other crops. Cowpea forage forms a good substitute for lucerne hay. One variety seems almost as good as another except that the "bush" sorts are easier to reap than those with long spreading vines.

"*Unknown*" *Cowpea.*—Grew splendidly: suits this part well.—H. J. Gurr, Lydenburg, 1905-06.

"*Whip o' Will.*"—Sown too late (12th December): promised well but cut down by frost on 10th April, just before quite ripe. Shall sow a large field next season.—R. C. Biggs, Rietspruit, Middelburg District, 1907-08.

Did very well and made a good hay, readily eaten by all stock; gave a fairly heavy yield.—J. G. Hamilton, M.L.A., Northdene, Pretoria District, 1907-08.

KAFFIR BEAN (*Vigna Catjang* var.)

This is a running variety of cowpea, and has been grown locally by the Kaffirs for many years. It is well acclimatised to the Transvaal, and for the present seems a more certain crop than the cowpea. A large number of trials have been carried out, and this crop, like the cowpea, is more particularly suited to the climatic conditions of the high and middle velds; in the upper and lower bushveld the velvet bean will prove more valuable owing to its heavier yield. The kaffir bean can be put to the same uses as the cowpea, and only requires to be known by farmers to be better appreciated. In the Pretoria District, the Groot Marico and the Potchefstroom Districts, successful summer catch crops of kaffir beans could be taken off the land after the winter wheat crops are harvested, and in this way the fertility of the soil could be considerably increased.

This was the most successful crop raised on the farm this year; sown 27th November, 1905: harvested 9th April, 1906.—P. McA. Maynard, Pyramids, Pretoria District, 1905-06.

Came up well and were ploughed in for green manure.—J. L. Reid, Rustenburg District, 1905-06.

A most suitable crop: makes excellent hay.—E. C. Long, Rietfontein, Lichtenburg District, 1906-07.

Grew splendidly, a most promising crop until destroyed by hail.—F. C. Mallet, Bloemhof District, 1906-07.

Does best of all the bean crops here; we also had a very good crop from our own seed sown on a larger scale. Makes a good hay, which is readily eaten by all stock.—J. G. Hamilton, M.L.A., Northdene, Pretoria District, 1907-08.

Did well considering drought, and being quicker maturing did not suffer from drought so much as velvet beans.—P. Fowlis, Koedoespoort, Pretoria District, 1907-08.

HYACINTH BEAN (*Dolichos Lablab*).

This is a comparatively new crop, having only been introduced into the Transvaal about two years ago by the Agricultural Department. Results are not yet conclusive, and further experiment is required, but it seems that the hyacinth bean is proving a valuable

crop for our warmer localities, and that, if anything, it will yield more heavily than the velvet bean. It does not appear so suitable for the high veld, as it takes too long to mature.

Grew very well, but was sown too late and cut off by frost while in flower.—F. Mockford, Zoutpansberg District, 1906-07.

Did well and I let all go to seed; yield fairly good: sown end of November.—J. G. Hamilton, M.L.A., Northdene, Pretoria District, 1907-08.

Grew well, but suffered more from drought than velvet beans or kaffir beans; yield of seed saved very small.—P. Fowlis, Koedoespoort, Pretoria District, 1907-08.

* Lupines (*Lupinus* spp.)

Three varieties have been tested, the white (*L. albus*), the yellow (*L. luteus sativus*), and the blue (*L. angustifolius*). Owing to the poisonous properties they contain lupines are a rather dangerous feed for stock, and are mainly useful for green manuring. Good results have been obtained at Potchefstroom when sown as a summer crop, and it has been proved at Skinner's Court that they can be sown in warm localities as winter crops under irrigation and ploughed in about September. Used in this way lupines should prove valuable for green manuring on exhausted tobacco land or citrus orchards.

Good results are also reported from Vereeniging where lupines have proved useful as a winter crop on dry land.

Soybeans (*Glycine hispida*).

The main use of the soybean is as a pulse crop, the bean forming an excellent substitute for the English horse-bean. It is a rather difficult and uncertain crop to grow, and results are often unsatisfactory; germination also is frequently defective. Good crops have been grown on the Pretoria Botanical Experiment Station, and also in the Middelburg, Zoutpansberg, and Pretoria Districts. Last season a very successful crop was reported from the South Witwatersrand District. We have now obtained locally-grown seed, and hope that this will give better results than the imported seed has done.

A most satisfactory crop. 2 lbs. seed yielded 45 lbs.: sown 15th November, 1905, reaped 19th April, 1906.—W. Cullen, Modderfontein, Pretoria District, 1905-06.

Did very well and much relished by stock, but destroyed before seed ripened. Roots covered with nitrogenous nodules.—D. F. Buchanan, Goede Hoop, Zoutpansberg District, 1906-07.

Grew very well indeed, one pound of seed yielded 26 lbs.—F. Mockford, Zoutpansberg District, 1906-07.

Velvet Beans (*Mucuna utilis*).

An excellent heavy-yielding annual leguminous crop, valuable either for hay, ensilage, soiling, or green manure. Appears particularly well-adapted for growing as a summer green-manure crop in citrus orchards or on irrigated wheat lands. A valuable meal for feeding to stock is obtained if the bean is ground in the pods. The crop is rather a slow grower and seldom matures on the high veld, where kaffir beans or cowpeas will usually be found more satisfactory.

Grew splendidly.—H. L. Hall, Riverside, Barberton District, 1905-06.

Sown too late, 23rd January: killed by frost on 13th April when just in pod. Shows signs of having been beneficial as a green manure.—T. W. Sephton, Rickertsdam, Marico District, 1906-07.

Never made any growth.—Fisher Bros., East Rand, Witwatersrand District, 1906-07.

Sown in an orange orchard. A splendid crop, if anything, too luxuriant.—Winter Bros., Barberton District, 1906-07.

Do well and make a most valuable feed, but do not seed well here nor do they yield so heavily as kaffir beans.—J. G. Hamilton, M.L.A., Northdene, Pretoria District, 1907-08.

Sown 5th November. Grew splendidly in spite of drought and made enormous growth. Slow to mature seed and frosted on 10th April. Splendid for green manure.—E. J. Brown, Mimosa Vale, Wolmaransstad District, 1907-08.

Have done very well though rather neglected; cattle and sheep now grazing on the crop.—J. W. van Waveren, Daamplaats, Zoutpansberg District, 1907-08.

Pea-Nuts or Ground-Nuts (*Arachis hypogæa*).

Four varieties have been experimented with—the local kaffir nut, the Spanish, the Mammoth Virginian, and the Mauritius nut. Trials have been made in many districts of the Transvaal, and results indicate that the crop is best suited to the bushveld and low country. Good crops have been grown in the upper bushveld and in the south-western Transvaal, but in these districts, and without special machinery, labour seems too costly at present to permit of profitable crops being raised. Pea-nuts have also done exceedingly well in Swaziland.

The crop does best on light, sandy soils or light loams, and, being a leguminous plant, it may be expected to enrich the soil in nitrogenous plant-food for the following crop. The haulm is also useful as a stock food.

Experiments indicate that the Virginian Mammoth is not only the heaviest yielder, but is also considerably earlier than other varieties tested, though in actual oil-content analyses made by the Chief Chemist show it to be slightly inferior to the Mauritius variety. Results on the high veld are not usually satisfactory, but it seems likely that the Virginian Mammoth may prove a useful pig food in these districts if the animals are allowed to root out the crop for themselves.

"*Local Variety*."—Crop disappointing, made excellent upper growth and plenty of nuts, but most of these were empty.—A. C. van Maarseveen, P. P. Rust, Waterberg District, 1905-06.

"*Spanish*."—Came on well, but just as crop was maturing seed it was attacked by some grub and I had to reap before quite ripe.—E. F. Bourke, Kalkland, Pretoria District, 1905-06.

"*Virginian Mammoth*."—Did pretty well but yield lessened by drought; 10 lbs. seed yielded 240 lbs.—R. Nolte, Warmbaths, Waterberg District, 1906-07.

Crop did very well, but owing to heavy rains a great proportion of the seed germinated in the kernels and so was not worth reaping.—Jas. Fullerton, Piggs Peak, Swaziland, 1906-07.

Grew very well and stood drought splendidly; nuts very large; yield forty-fold.—J. Oswin, Bremersdorp, Swaziland, 1907-08.

Did well here. I did not earth them up; earlier than the Mauritius nut.—E. van Musschenbroek, Grootvlei, Standerton District, 1907-08.

Only about 50 per cent. germinated; these did well though hardly having a fair trial. I estimate the yield at about 27 bushels per acre. (A bushel equals 22 lbs.)—C. M. Quarry, Warmbaths, Waterberg District, 1907-08.

Did very well indeed; estimated yield 15½ bags, or about 55 bushels per acre.—A. Tandler, Warmbaths, Waterberg District, 1907-08.

The "Mauritius" nut is a month later than the Virginian Mammoth, and apparently very inferior as regards yield and quality.—F. H. Buckham, Bremersdorp, Swaziland, 1907-08.

The "Mauritius" nuts did fairly well, but suffered from drought and were eventually a good deal damaged by frost. Will do here, I think, if not sown later than the middle of October.—A. W. Reid, Dwaalfontein, Middelburg District, 1907-08.

(To be continued.)

VI. WHEAT GROWING IN THE TRANSVAAL.

By H. Godfrey Mundy, P.A.S.I., Assistant for Field Experiments.

Some idea of the importance of the wheat-growing industry to the Transvaal may be obtained from the following statement of the wheat imports during the years 1906 to 1908. The figures are quoted from the official reports of the Customs Department, and show that though in the three years under review the value of the total imports has decreased by approximately £50,000, there is still a vast deal to be done before the Transvaal can be self-supporting in this respect.

	1906. Weight.	1906. Value.	1907. Weight.	1907. Value.
Wheaten Flour (oversea)	lbs. 98,344,719	£440,478	lbs. 88,205,409	£394,982
Flour, ground ex. S.A. Wheat	10,523,699	44,085	18,577,545	77,822
Wheat	3,639,978	15,537	3,346,245	12,976
Bran	20 347,427	50,973	16,398,685	41,700
	lbs. 132,855,823	£551,073	lbs. 126,527,884	£527,480

	1908. (1st January to 30th November.) Weight.	Value.
Wheaten Flour (oversea)	lbs. 72,164,435	£369,943
Flour, ground ex S.A. Wheat ...	15,872,790	72,760
Wheat	2,587,020	11,580
Bran { South African Produce ...	11,111,304	27 652
Bran { Oversea	17,218	81
	lbs. 101 752,767	£482,016

During the past season the writer has visited the main winter wheat-growing districts of this Colony, and it is a remarkable fact that in spite of the high price which good quality wheat commands but little more scientific care and attention seems to be devoted to the cultivation of this valuable crop than to the more commonly grown maize or kaffir corn.

Some farmers state that the difficulty of transport and the lack, until lately, of railway communication with some of the wheat-growing districts—both causes giving rise to a confined and easily over-supplied market—are largely answerable for this state of affairs. Be that as it may, it is a plea that will no longer hold good, since, with the exception of Lydenburg, to which the railway line is now under construction, all the other large wheat-producing districts have excellent facilities for placing their produce on the central markets of the Transvaal.

Supply and Demand.

During the year 1907 wheat and wheat products to the value of £527,480 were imported into the Transvaal, and this in spite of the fact that our own wheat crop for that year was computed at somewhere about 100,000 bags (20,000,000 lbs.) Owing to difficulties of transport, etc., it is probable that a certain proportion of this amount failed to reach the central markets of this Colony, but, in any case, if the present production is taken at 100,000 bags (20,000,000 lbs.) per annum, and the average yield at eight bags per acre, there is still need of another 50,000 acres under wheat before the local supply can equal the demand; and even if this can be achieved, there is always

the rapidly increasing world population to be considered and the large oversea wheat market to be supplied.

Only recently the Department of Agriculture has received enquiries from an enterprising firm of South African millers regarding the Transvaal annual output of wheat, as, if the supply warrants it, they suggest establishing a large and thoroughly equipped up-to-date milling plant in some central position, where amounts ranging from 10,000 to 20,000 bags per month could be dealt with. It will be seen that with even one mill of this capacity the entire annual wheat crop of the Transvaal, would hardly suffice to keep it running the whole year round, and farmers need therefore be under no apprehension of over-supplying the market. Moreover, with a large and increasing local demand there is little fear of the local price of wheat dropping to any appreciable extent; once threshed wheat is a readily realisable product, and may be termed a "spot cash" crop.

Means of Increasing our Production.

In visiting the winter cereal-growing centres such as Lydenburg, the Klein Marico, and the Groot Marico, one cannot fail to be struck by the large—may we say the unnecessarily large—areas which are devoted to the growing of winter oats for forage. On comparing the monetary returns from the two crops the fact is still more surprising.

As far as we are able to arrive at it, the average yield of wheat from irrigated land in the Transvaal is from 8 to 12 bags per acre (16 to 24 bags per morgen), and if reports are to be relied on 12 to 16 bags per acre is no uncommon yield on good land and with proper cultivation.

Taking the value of wheat on the farm at 16s. per bag, this will give a return of anything from £6 8s. to £9 12s. per acre. With oats, on the other hand, the ordinary yield of forage does not appear to often exceed 500 to 700 bundles per acre (1,000 to 1,400 bundles per morgen), and with average prices ranging as they have done during the last nine months at 12s. to 15s. per 100 bundles (£3 to £5 5s. per acre), it is evident that a better profit can be made from the wheat crop than from oats. While in addition, with the former the grower retains the straw, which can be baled and fed to stock or trampled in the kraals and converted into manure, whereas with oat forage the whole crop is usually sold off the farm and nothing returned to the land in compensation.

The reason assigned for the growing of so much oat forage is usually that the land is too poor to grow remunerative crops of wheat. It is a matter of common knowledge that during the last few years Algerian, Egyptian, and Colonial oats (haver) have largely taken the place of the true Boer haver; in the same way with wheat, wol koren is now more commonly grown than klein koren. The reason for this is that Boer haver and klein koren both require rich, well-tilled land, whereas the other varieties mentioned will give proportionately better yields on poor and exhausted soils. When it is considered that Boer haver produces forage considerably superior to that obtained from either Algerian or Colonial oats, and that klein koren is thought the best milling wheat at present grown in the Transvaal, the need for maintaining the fertility of our irrigated lands and so permitting the growing of these superior strains of wheat and oats becomes more than ever apparent.

Arguments in favour of Increasing the Area of Land Sown to Wheat at the Expense of Oats.

As a better knowledge of the principles of feeding farm stock in general, and in particular of animals doing hard and continuous work in the towns, is obtained, it is gradually being recognised that oat forage is neither the most economical nor the ideal feed.

Large areas of suitable land are now being laid down to lucerne, and Transvaal-grown lucerne is yearly becoming a more common product on our local markets. As the value of lucerne hay becomes better known, it is likely to injuriously affect the sale of oat forage, and it is to be expected therefore that in the near future the local consumption of oat forage will tend to fall off, and if production is maintained as at present a consequent drop in prices may be looked for. With wheat, on the other hand, the demand is constant, and prices are not liable to much fluctuation. Most of the land on which irrigated wheat and oats are grown is also well suited to the cultivation of lucerne, and the annual yield of fodder from an acre of lucerne well cultivated and cared for will usually far exceed the return from a similar area of oats both in bulk and in monetary value either for market or for home feeding.

The following comparisons of the returns from an acre of lucerne and an acre of oats may be instructive. An acre of lucerne drilled in rows 18 inches apart and of two years' standing should give, if properly cared for, at least four cuttings during the summer months; in the bushveld and in many of the wheat-growing districts six cuttings would not by any means be too much to expect. The average yield per acre per cutting may be taken at three tons of green fodder or one ton of dry forage when converted into hay, while the present value of the hay, at a low estimate, may be taken at £4 10s. a ton all over.

Estimating the yield of oat forage at 700 bundles (i.e. 2,450 lbs.) per acre at a value of 15s. per 100 bundles, and that of lucerne hay at 4 tons per acre, worth £4 10s. per ton, we see that the advantage both in yield and value is considerably on the side of lucerne.

Water Supply for Irrigation Purposes.

During the past winter many of our wheat-growing districts, and, in particular, the Klein Marico, have suffered from a shortage of water for irrigation purposes. With lucerne, irrigation is practically confined to the summer months, as the crop remains more or less dormant during the colder months of winter. In summer rivers and dams are usually well supplied, and much of the water which then runs to waste could, with advantage, be led on to the lucerne lands. Lucerne, moreover, is a perennial crop, and requires little or no attention during the winter. This is an important point on an irrigated farm, where, if the land is to give the best return, one crop must follow another in rapid succession, and where the rush of work often makes it difficult to find time to properly prepare the ground for the succeeding crop.

When a certain proportion of the land can be profitably laid down to a perennial crop such as lucerne, which mainly requires attention during the summer months, the work of the farm can be

more evenly divided over the whole year. If then, by growing one acre of lucerne we can reap during the summer months three times as much fodder, of better feeding value and of higher market worth, than we could during the winter months from a similar area sown to oats, it is clear that we can afford to increase the amount of our wheat lands at the expense of the oat crop, and further, that this can generally be done with the use of the same quantity of irrigation water as is at present available.

Kinds of Wheat to Grow.

It must not be thought, however, that as long as the farmer increases his wheat production he is doing all that is required of him in his own interests. He must go further, and produce those wheats which are in the highest demand, and for which millers will give the best price. The up-to-date miller does not wish his wheats to be mixed for him by the farmer—his aim is to produce certain kinds of flour suitable for definite purposes, and, in order to do so he must blend his wheats in fixed proportions. If the farmer has already done this by growing two or three different varieties mixed together in the same field, it is evident that the miller cannot well control the blending of such wheat, and will not be prepared to offer the same price for it as he would for pure unmixed wheat of the best quality.

The importance which millers attach to the necessity of obtaining pure wheat of good even quality may be gathered from the following extract, taken from a circular addressed by a large American milling company to the numerous farmers from whom they purchase their supplies:—

"*Three things essential for good wheat crops*—Good Clean Seed, Ground Well Prepared, *and* Rotation of Crops. *These three things, if practised unremittingly, will ensure good results. Your seed should be absolutely* Good, Pure *seed.*"

Firstly, therefore, the Transvaal wheat grower must grow those wheats which are best liked by the miller; and, secondly, he must grow these pure.

At the present time, with a few notable exceptions, one cannot walk through a field of irrigated winter wheat in the Transvaal and find it an entirely pure stand. Wol koren is mixed with klein koren; wit klein koren with rooi klein koren; and wit wol koren with rooi wol koren.

Types of Wheat to Grow.

Wheat farmers must no longer be content to grow their crops for the sole purpose of supplying the needs of their own families, and their own immediate neighbourhood—they must look to the large central markets of this Colony and of the rest of South Africa; and, further, they must bear in mind that there, flour milled from Transvaal wheat will come into open competition with the various patent American flours milled from the world-famous American and North Western "hard" wheats.

Probably the commonest and best-known local winter wheats are the following:—Wit klein koren, rooi klein koren, wit wol koren, rooi wol koren, and holstrooi. Of these the klein korens are of the type known by millers as hard wheats, while the wol korens and holstrooi

come under the heading of soft wheats. There is always a ready market for both types, though the soft wheats are more plentiful, and hard wheats usually command a better price. Flour milled from hard wheats is particularly desirable, in that it has the power of making shapely, well-piled loaves, and this is the kind of bread the consuming public in the towns insist upon having. A considerable number of inferior strains of wheat are at present grown in the Transvaal, and it must be the aim of farmers to substitute better-liked varieties in place of these. A few instances are Talavera, Zwartbaard, and a wheat sometimes known as "dubbel aar." Frequently the reason for growing those is poorness of soil but in other cases they appear to be the varieties best suited to certain districts, as, for instance, Talavera, in the Wemmershoek Ward of the Lydenburg District. The first difficulty can be overcome by better methods of cultivation, while that of climatic conditions must be combated by the introduction of new and improved varieties suitable to those conditions, but of better milling quality than the wheats now grown.

The causes of our wheat lands becoming exhausted are threefold:—

(*a*) Lack of proper cultivation and working of the soil.
(*b*) Scarcity of manure.
(*c*) Neglect of any system of rotation.

Lack of Proper Cultivation.

Until the land became too exhausted to carry the two crops, it was a common practice to grow continuous crops of wheat in winter and maize in summer. This meant that not only was the land called upon to provide food for luxuriant feeding plants the whole year through—frequently without any adequate compensation in the shape of manure—but it further prevented proper cultivation of the soil, as the time between the reaping of the wheat crop and the sowing of maize was seldom sufficient to permit of more than the most scanty tillage operations.

It is a recognised fact that on land which is frequently submitted to floodings, that is, irrigation, the various salts present in the soil and forming the sources from which plant life derives nutriment become washed into the lower strata or subsoil, and are there more or less unavailable to other than deep-rooting plants. The whole theory and practice of tillage operations is to stir and pulverize the soil in such a manner that these food constituents may be brought into contact with the roots of the growing plant, and unless deep ploughing and thorough cultivation are resorted to the land becomes less productive each year. It is better policy, therefore, either to forego the summer crop of maize altogether and to fallow the land or to sow quick-growing summer catch crops which will permit of the land being properly worked after the wheat crop has been harvested.

Scarcity of Manure.

Scarcity of kraal manure is a common cry, and yet how few farmers take any steps to augment their supply. It is fully recognised that owing to stock diseases many wheat growers in and about the upper bushveld have but few stock to produce manure, but if each week a few tons of wheat straw (which is often otherwise

wasted) were spread over the floor of the kraal, farmers who have not already adopted this practice would be surprised to find how much more manure they can take out at the end of the season. Such manure, moreover, contains a large amount of humus (decayed vegetable matter), which is not only in itself a plant food, but further tends largely to increase the moisture-retaining properties of the soil.

Green Manuring.

Green manuring (the ploughing under of leguminose crops) is one of the most valuable methods of maintaining and increasing soil fertility that is known. It consists of growing leguminose crops, such as velvet beans, cowpeas, kaffir beans, etc., which have the power of taking in free nitrogen from the air by means of minute bacteria living in symbiotic relationship with the roots of the plant. These bacteria live in small excrescences called nodules, and in these the nitrogen is stored up.

When the crop is mature it is ploughed under, and as the roots and nodules decay the stored-up nitrogen is set free and enriches the soil in this essential plant food. The leaves and stem of the plants go to form humus, which is itself a plant food, and which further greatly improves the physical condition of the soil, giving it a better water-holding capacity, etc.

If the land is already fairly rich, and all that is needed is to maintain its fertility, the leguminose crops, when mature, can be cut for forage in the same way as lucerne, and will then give a fodder of almost equal feeding value.

Many wheat farmers already practice green manuring on a small scale, but this might be done systematically in such a way that every part of the lands will participate in this system of cropping every third or fourth year.

The following skeleton of a rotation may be taken as an example; the crops grown can be adapted to meet local conditions; and where more kraal manure is available it can be applied accordingly:—

	1909.	1910.
Winter—May to November approximately	Wheat	Wheat, or in part oats.
Summer—Dec. to April approximately	Velvet beans ploughed under ...	Maize.
	1911.	**1912.**
Winter—May to November approximately	Wheat	Wheat, or in part oats.
Summer—Dec. to April approximately	Land dressed with kraal manure, potatoes, or some other cleaning crop	Velvet beans, either ploughed under or cut for forage.

Labour-Saving Machinery.

Before concluding, a word must be said about machinery. There seems an undue prejudice against labour-saving machinery of any description, but if the Transvaal grower is to successfully compete with foreign producers, he must use every means in his power to improve the quantity and quality of his crops, and to reduce the cost of his labour. The efficient use of machinery is one of the means to this end.

Reapers and binders are gradually making their appearance in our wheat fields, and, with the ubiquitous ox as a means of locomotion,

can be made to do excellent work. Irrigation furrows are a source of difficulty, but not an insurmountable one. Such furrows can be readily filled up by the use of a small plough, and the time which this operation takes is easily compensated for by the quick and thorough job that a reaper and binder will make of the crop.

Some farmers hold the opinion that the climate is too wet for the use of these machines—it is questionable whether the period over which our winter wheat harvest extends is any wetter as a rule than the corresponding time in Europe, yet there reapers and binders are almost universally used.

Last, but by no means least, is the difficulty of uneven ripening; one seldom sees a wheat field evenly ripe all over. One of the reasons for this is that with the present method of sowing, that is, by hand, the seeds are buried at different depths, and the resulting plants mature at different dates. A similar effect is caused by the very thin sowing which is often practised on good land—the plants standing thin on the ground stool out enormously, and the result is that when the crop is reaped about one-third of the grain is in the right condition for cutting, one-third is under-ripe, while the remaining one-third is probably over-ripe, and much of the grain has scattered. Unripe, ill-developed grains injure the quality of the sample, while scattering, of course, reduces the yield.

Drilling the seed ensures sowing at a uniform depth and width; an even stand throughout is obtained. The difficulty of the crop standing too thick in one place and too thin in another is obviated. If wheat growing is to occupy its right position in the Transvaal, and if our irrigated lands are to produce to their fullest capacity, improvements in all-round cultural methods must be made. In the writer's opinion wheat crops throughout the country would be much benefited both in quantity and quality by the systematic use of the drill in sowing and the binder in harvesting.

VII. COTTON BY-PRODUCTS.

By Walter H. Charter, Government Estate, Tzaneen.

In view of the increasing area now planted to cotton in the Zoutpansberg and Northern Transvaal, the following notes on the value of cotton by-products have been prepared in order to show that the lint is not the only valuable product of the cotton plant. For a hundred years, in the Southern States of America, cotton seed used to be regarded of so little use, and such a nuisance, that ginneries were built near to, and even over, streams in order that the seed could be washed away, as the accumulating heaps of decomposing and rotten seed on the land had proved a serious menace to health. Times have now altered, and the seed is worth practically one-fifth of the value of the cotton crop. At first the seed was allowed to partially decay, and was then returned to the land to supply plant food for future crops. Now, after the seed has been subjected to varied treatments and valuable oil, etc., extracted, the residue is made into cattle food, and after it has been fed there is still available three-fourths of the original fertilizing value in the manure from the animals.

A ton of 2,000 lbs. of seed cotton usually averages 665 lbs. of lint and 1,335 lbs. of seed; 18 lbs. of lint or short fibre still remains on the

seed after ginning. From the seed can be manufactured or prepared 490 lbs. of meal and 186 lbs. of oil; 561 lbs. consists of hulls (also used for feeding), and the balance of 80 lbs. is waste material such as dust, sand, etc.

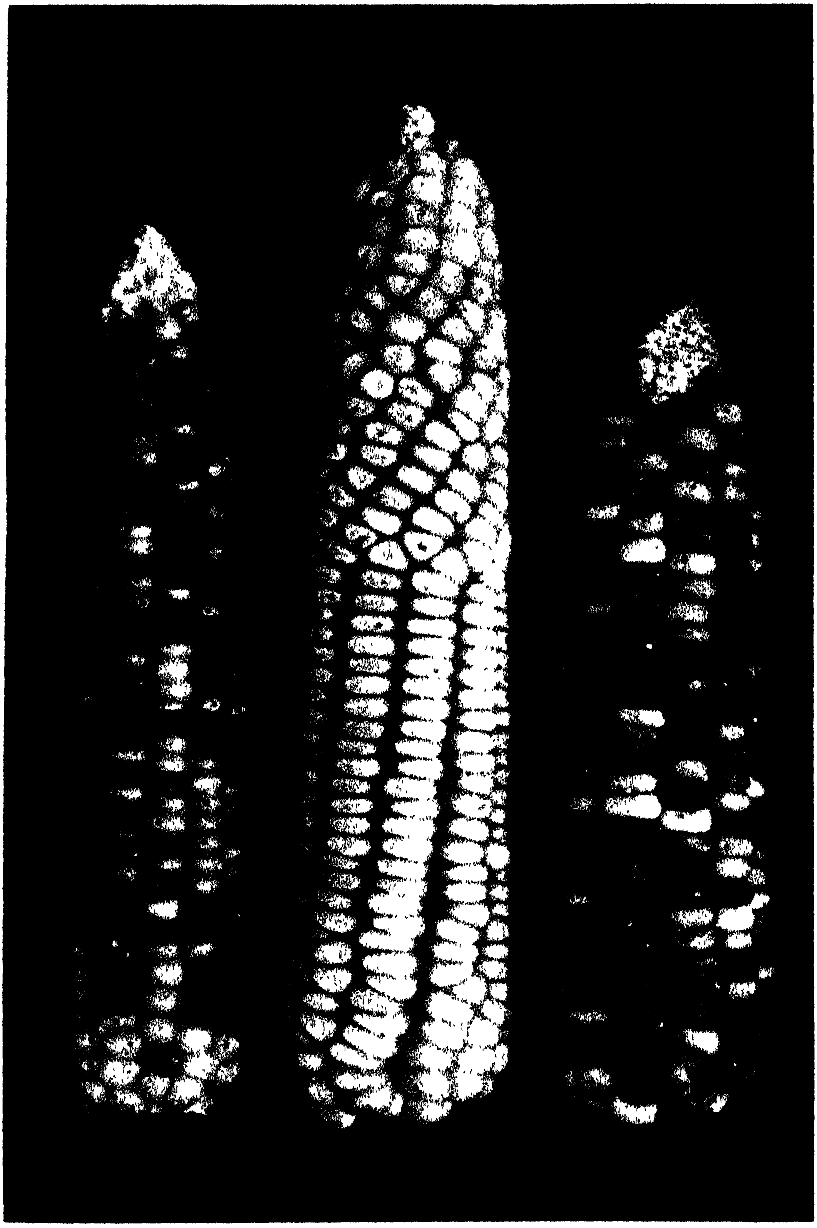
A farmer should secure two profits from his cotton seed—one by feeding and the other by fertilizing, and it is waste to forego either one of these profits. By the practice of feeding cotton seed or its equivalent in meal, the feeding value is got out of it, and it can afterwards be returned to the soil in the form of manure, which is rapidly available as plant food for the forthcoming crop. It is stated that 100 lbs. of ground cotton seed equals in feeding value 116 lbs. of maize, and 100 lbs. of cotton-seed meal equals 175 lbs. of maize. The wanton waste, therefore, of burying valuable cattle and stock food to slowly rot in the ground, instead of feeding it, must be apparent to all; and seed thus wasted is a dead loss to our agricultural interests. There is still much to learn as to how best to combine cotton-seed meal with other foods in order to secure the very highest feeding value possible, and it is within the range of possibility that human food also will be produced from it, as cotton-seed meal contains all the elements necessary for wholesome, nutritious food.

Failure to return the cotton seed to the soil in some form or other leads to depletion and poor crops. From a fertilizing standpoint the oil contained in cotton seed is more objectionable than serviceable. For feeding to live stock it is unfavourable to digestion, and the oil is of no use to the soil, nor is it a source of food for the plant. Consequently it is to the farmer's benefit to have the oil extracted from his seed so that the latter may become of more value to him as a feed or a fertilizer. In artificial manures nitrogen is the most costly element of plant food that is purchased, and for this reason its production by means of home-made manures must be very carefully taken into consideration. Cotton-seed meal contains 7 per cent. of nitrogen, or 40 lbs. to the ton. Its decay in the ground is rapid, although its effects are lasting. Nitrate of soda is more rapidly available as plant food, but soon becomes exhausted.

Cotton-seed meal is food for the animal, but not for the plant until nature does for it exactly what the animal does to it. Much of the cotton-seed meal produced in the Southern States of America is shipped to Europe for use on the dairy farms there. This is not the most economical method of treatment, for every ton of meal exported means so much lost fertility, which will have ultimately to be replaced by more expensive methods; and in South Africa an effort should be made in the cotton-growing areas to combine cattle raising and cotton growing.

With East Coast fever still in the land it is in many instances impossible to raise cattle, but horses and mules may have a limited ration of meal, and pigs also. Just as soon as the cotton-growing districts are free from cattle disease then it will be the time for the farmer to combine cattle raising with cotton cultivation, always remembering that the better the class of animal fed the sooner maturity is reached and the sooner the farmer pockets the profits.

The cost of transportation and seed storage is a disadvantage in the manufacture of oil and meal, and it is advisable to have small mills right in the heart of the cotton-producing areas, so that such mills do the work of the surrounding community and lessen the cost



Xenia in Maize, and injury caused by the Angoumois Grain-Moth.

The central ear shows the effect of pollen from a yellow breed, on the ear of a white breed.

The two outer are the second generation ears from a cross (the previous season) between a black sugar and a white flint and show the splitting up into four types of grain black flint, black sugar, white flint, and white sugar A fifth form (yellow flint) has appeared through the addition (during the present season) of a little pollen from a yellow flint. The white sugar will breed true being "recessive" for both sugariness and whiteness, but the white flint may produce both white flint and white sugar, flintness being "dominant"

The round holes are caused by the larvae of the Angoumois Grain-Moth.

of transport. A co-operative mill has an advantage in that it has the interested support of the farmers and growers of the neighbourhood. As a commercial enterprise large mills at certain centres are all very well, but the seed is the product of the farm and should be consumed on the farm. By sending it long distances so that it cannot be economically returned, we rob the land on which it was grown.

In addition to the above, a ton of cotton seed yields something like 40 gallons of crude oil, therefore the oil obtained from many tons of seed can be transported long distances to a central refinery in a small bulk space, thus showing the advantage of having small oil mills situate in the centre of each cotton-producing district. Two products are obtained from the crude oil, the crude oil proper and the settlings; the first are barreled for shipment and the latter are used as soap stock. Refined oil is largely used in the manufacture of butter compounds, and the higher grades are used for oil for cooking, salad dressing, etc. Cottolene, a substitute for lard, is also manufactured from refined oil after bleaching, and is a very popular product.

The best solution of the cotton seed question is a co-operative oil mill established in the centre of the growing district. To this mill all seed should be brought and the oil extracted and put on the market as a commercial product, and the meal and hulls returned to the farm to feed stock and replace the fertility drawn from the land by the cotton crop.

VIII. MENDELISM IN MAIZE.

By Joseph Burtt-Davy, F.L.S., Government Botanist.

If two maize plants differing in the presence or absence of one of a pair of *contrasted characters* (e.g. yellowness or whiteness of grain) are cross-pollinated, only one of these characters appears in the progeny of the first generation. This is therefore called the *dominant* character, because it dominates the other. The opposite character is present in the cross-bred progeny, but is hidden by the one that is dominant; it is therefore called the *recessive* character. This law is known as the *law of dominance;* it applies in a large number of cases, but not in all. It may not apply if the parent plants used in making the cross are not pure-bred as regards the particular pair of contrasting characters in question.

Mendel's second law, or *law of inheritance*, treats of the way in which such contrasted characters are transmitted in subsequent generations. In the second and following generations each one of the parental pair of contrasting characters reappears in the self-pollinated plants grown from cross-bred seeds. These characters occur in *definite proportions*, viz. three of the dominant to one of the recessive, but these proportions are only found to be precise when large numbers are dealt with.

Furthermore, self-pollinated plants bearing the recessive character continue to breed true from generation to generation; but of those plants bearing the dominant character only one-third are dominants which persistently breed true; two-thirds are cross-breds which contain the recessive character, though hidden, and which continue

generation to generation to split up into the same proportion of dominants and recessives.

Let us take an example by way of illustration. If the silks of a white breed of maize are dusted with pollen of a yellow breed so carefully that no other pollen is allowed at any time to reach those silks, *all* the grain produced on that ear will be *yellow*.

If the yellow grains so obtained are sown by themselves, and the silks produced by those plants are carefully pollinated with pollen from the same plants—the same care being taken to prevent pollen from other plants reaching them—the ears produced will bear *some white* and *some yellow* grains. By counting the grains on a number of ears (some thousands of grains in all) it will be found that, *on the average*, there are three yellow grains to every one white one.

If these white grains are sown by themselves and the same care taken that the silks produced by the new plants are pollinated only with pollen from their own tassels, it will be found that the ears produced bear *only white* grains.

But if the yellow grains are sown by themselves, and in the same way pollinated with pollen from their own tassels, one-third of the ears produced will have only yellow grains, one-third will bear ears with both white and yellow grains, and the remaining third may have either all yellow, or some yellow and some white grains.

As the pollen from a yellow breed changes the colour of the grain of a white breed to yellow, yellowness in maize is said to be *dominant* over whiteness; whiteness, because it is masked by the dominant colour yellow, is said to be *recessive*.

In the same way blackness or blueness are dominant to whiteness and also to yellowness. Flintiness of grain is dominant to dentness of grain, and so also is the wrinkled appearance so characteristic of sugar (or sweet) maize.

The laws which govern these facts having been first discovered by Gregor Mendel, are known as Mendel's laws. They may be stated simply as follows:—When a dominant character is crossed with a recessive the progeny of the first generation shows only the dominant character. If the progeny are inbred, the second generation yield 75 per cent. dominants and 25 per cent. recessives. The 25 per cent. which are recessives will breed true, and another 25 per cent. which are dominants will also breed true. The remaining 50 per cent. will again split up into 75 per cent. dominants and 25 per cent. recessives. These proportions may only show accurately when large numbers (some thousands) of individuals are dealt with.

Other—but not all—characters of plants than colour and chemical composition of the grain are subject to Mendelian law, e.g. height, leafiness, and time of maturity. Just how many and which other characters has not been fully determined, but there are indications that protogyny, number of rows of grain per ear, thickness of cob, etc., are included.

It is of great importance to the future improvement of the maize crop that a complete scientific investigation of Mendelism in maize should be made. When it has been determined that certain characters are subject to these laws, and which of them is recessive to its opposite, it will be possible to make use of this knowledge to add desirable characters to breeds which in other respects meet local needs.

The Horticultural Section.

I. PHYLLOXERA-RESISTANT VINES FOR THE TRANSVAAL.

By R. A. Davis, Government Horticulturist.

The invasion of this Colony by the much dreaded *Phylloxcra vastatrix* has at last taken place. It would be too much to say that this had been entirely unexpected, as it was well known that large numbers of European vines had been shipped here from Cape Colony in pre-war days which had not been worked on roots which were resistant. Unfortunately very little precaution appears to have been taken in those days as to whether insect pests were admitted or not, and one result is that to-day the abovementioned most destructive scourge has appeared at Mr. S. Marks' farm, Zwart Kopjes, Pretoria District. The suspicious appearance of certain vines was first noticed by Mr. D. Haumann, the farm manager, and investigations by the members of the Division of Entomology of this Department placed the matter beyond doubt.

In order to do all that is possible to prevent the spread of the trouble, it has been decided that no grapes, cuttings, or portions of any vine standing in the vineyard attacked shall be removed and sold on the market; but that, contrary to custom, the grapes shall be pressed and made into wine. Afterwards, when the crop is off, all the vines will be uprooted and burnt.

This is drastic treatment, but it must not be forgotten that when once the *Phylloxera* enters a country it can only be dealt with by heroic measures; no manner of treatment has ever been found to be of any avail, and the sooner the question is boldly faced the better.

The situation at present existing with regard to the vine-growing industry in the Transvaal is as follows:—There are a large number of vineyards, especially in the Losberg Division of the Potchefstroom District, which are planted either from layers or cuttings of European non-resistant varieties of vines. An equally large acreage of vines, grafted largely on American resistant stocks, exist in the neighbourhood of Johannesburg, many of which are wine varieties only. And, finally, the usual small vineyards and trellises found amongst all classes of gardens in nearly all the towns in the country, part of these—and only a small part—are on roots resistant to the attack of the *Phylloxera*, whilst the balance are the ordinary *Vitis vinifera* of Europe, all ready to fall an instant prey to the pest as soon as it comes along.

In considering how best to deal with the grape vine in this Colony under the conditions presented, it may be as well to state at once that there is no cause for serious alarm, excepting amongst those who have persistently planted non-resistant cuttings. Even here there is no cause for immediate dismay, for it is quite possible that some few years may elapse before the scourge gets to work, let us say, amongst the vineyards bordering the Vaal River. But eventually it will reach that, and all other districts in the Colony, and, when that time comes, it will be "good bye" to the vineyards

which are standing there to-day. It follows, then, unless vines with roots resistant to the attack of the *Phylloxera* are planted before the day arrives when the present vineyards are destroyed, that there will be no more grapes produced in that district.

Under these circumstances it is imperative that all vines planted from now on *must* be on resistant roots, if grapes, either for table purposes or wine-making, are to be produced.

Here is a chance for the nurserymen of our country to step in and produce what is wanted. Up to date only one or two individuals in the Transvaal have gone to the trouble of grafting vines for sale, and there is plenty of scope for work in this direction.

It is also possible that some of our farmers may desire to graft their own; so, for their benefit, a short description of the grafting process will be given.

Before passing to that, one cannot help congratulating those who have planted vines on resistant stocks, even at a considerable outlay of money and time. The consistent policy of this Division has been to advocate planting on these lines, and, indeed, a clause (No. 8) in the existing regulations affecting the import of insect pests and plant diseases was specially included, absolutely prohibiting the import, either from oversea or from other South African Colonies, of any vine other than those worked upon roots resistant to the attacks of *Phylloxera vastatrix*. It is possible here and there amongst those who have planted such that an occasional variety of vinifera has been worked on roots which have been somewhat unsuitable, but on the whole there has been little cause for complaint.

With regard to the small vineyards and trellises found in our towns, it is likely in time that these will also be attacked, and so it should be the correct policy in the future—even in the case of the householder—to plant resistant vines.

There are, one is often told, many disadvantages in being a young country. Against this statement it may be said that there are also some advantages, and the present question instances that. We have the experience of Cape Colony, Australia, California, and chiefly of France, on which to fall back; can examine the different methods of dealing with certain kinds of vinifera suitable for grafting on other American varieties, and generally adopt such as appeal to us, without going to the expense of costly experimental work. We already know, from work which has been in many cases most admirably done in Cape Colony, that some American varieties like, and will thrive, in certain soils, whilst other kinds will prove utterly useless; and it may be said here that work on our Experiment Station at Potchefstroom has gone far in proving the correctness of these statements.

It has been found, for instance, that the *Rupestris metallica*, which has proved successful in Cape Colony, is equally suitable in the Transvaal on soils which are somewhat dry, sandy, and stony. Its vigorous growth under adverse conditions marks it as especially suited for some of our poorer light loamy land. It does not do quite as well as some other rupestris varieties in soils which are inclined to be of a heavy or clayish nature, but, for an all-round stock suited for moderately dry conditions, it appears to be one of the best to use in this Colony for those varieties which do well on it. Practically everything with the exception of the Muscat type of grape has so far

shown more or less affinity for this vine, and its use is therefore recommended as a stock.

Riparia Gloire de Montpellier is another of the most successful graft-carriers amongst the American vines. Its name is suggestive of its origin, and it has the habit in South Africa of thriving best in soils of a heavier and moister nature than are needed for the Rupestris. It carries scarcely such a wide range of European varieties as the Rupestris, but those kinds which are suitable do extremely well on this as a stock. It is equally as resistant to the *Phylloxera* as the Rupestris varieties, and fully as vigorous in soil which it appreciates. It is impatient of drought, and it has been noticed in a very dry part of the Potchefstroom Experiment Station that it has made a very poor growth under such conditions, both grafted and ungrafted.

It is not any better suited to the Muscat type of grape than Rupestris, so the Jacquez has been called upon to act as graft-carrier for varieties of this type. It is an open question whether other vines of a resistant character will not soon be produced which will supplant the Jacquez. Certainly it is much to be desired, as the resistance of this vine to the attacks of *Phylloxera* is by no means what it might be. However, it has proved more suitable in South Africa than most other kinds for the grafting of Hanepot and grapes of that type, so has been largely used on that account. As a grower, it is equally as vigorous as either of the others mentioned, its only fault being that it is not entirely resistant. In order to show that it has some resistant power, the writer may state that he has seen a vineyard consisting of four varieties, three of which had been completely destroyed by *Phylloxera*, but the fourth, the Jacquez, remained healthy and vigorous. In this case it had been used not as a "resistant root," but as a direct producer or "self-bearer."

Besides the three kinds of American resistant vines which have been mentioned, there are innumerable others, either belonging to natural species or which have been improved by crossing. It is necessary to more than glance at these, and that for the following reasons:—The writer found some six years ago that the Catawba and Isabella, both vines of American origin, were being used here as "resistant" stocks. It is true that both these possess a certain amount of resistant power to *Phylloxera*, but it is only in a very slight degree. In a standard work on American vines by Messrs. Viala and Ravaz, both celebrated French authorities, a list is given of those vines which have been used for grafting purposes, and, in order to show the comparative resistant powers enjoyed by the different varieties, the number 20 is taken as representing the maximum resistance, or absolute immunity.

In comparing the varieties to which allusion has been made, we find that—

Riparia Gloire de Montpellier receives 18 points.
Rupestris metallica receives 18 points.
Jacquez receives 12 points.
Isabella receives 5 points.
Catawba receives 4 points.

So that for grafting a vineyard on roots which are to be relied upon as being resistant, the two latter varieties are best left severely alone. Both bear a small bunch of comparatively small berries, and the

peculiar "foxy" flavour which these possess is highly appreciated by some individuals; others again decidedly object to them. Both are exceptionally rapid growers, and cover up an empty space on a trellis very quickly. Other American varieties have been tried, and have failed, both in Cape Colony and the Transvaal, so it is of no use to go into that phase of the question, the object being to afford information with regard to resistant varieties which *are* satisfactory and suitable to the needs of this Colony.

It should be borne in mind that a strikingly prominent feature in the use of vines grafted on American stocks is the increased yield per vine. In some cases this amounts to 50 per cent. This, of course, should necessitate correspondingly good treatment and attention to the vines. None grafted on American stock should be planted in land which has not been trenched, and though 20 inches is sometimes deep enough, 2 feet 6 inches is better. Planting should not take place at insufficient distances. If grown in bush form, the closest should be not less than 6 feet by 6 feet, and if on trellis the rows should be quite 8 feet distant and the vines 12 feet apart in the row. It is recognised that this is contrary to present custom, but experience has shown that it pays both in yield of fruit and health and longevity of the vine.

Some years ago the writer planted out a vineyard in the Western Province of Cape Colony, allowing 6 × 5 feet and 6 × 6 feet as the standard spacing. This was the first ever planted in the Drakenstein District at those distances, and was regarded as somewhat of a foolish experiment. But it has been entirely justified by results, and to-day one finds a perceptible inclination to allow even greater space. The more room the roots are allowed the better the vine thrives, and were it not that the weight of the crop per acre might suffer, vines at 8 × 8 feet, as in California, would be frequently seen.

With regard to the actual grafting work, this is really very simple and can easily be learnt. In selecting cuttings for stock, one should take care to get the kind best suited to the land to be used, and equal care must be taken in selecting scions for grafting on these cuttings. Cuttings should only be taken from healthy vines which are *known to be good bearers*. If this is done, and a reasonable amount of care used in grafting, the result should be entirely satisfactory.

Sometimes the resistant vines are planted out either as cuttings or rooted in their place in the vineyard and grafted-over the following year. The result is occasionally highly pleasing, but it must be admitted that a large slice of luck usually attends a regular growth of the scions in such cases. By far the safest and most reliable method to start a vineyard is to plant the vines ready grafted from the nursery: one then gets 100 per cent. of stocks which will grow, and there are—or should be—no unsightly vacant spots.

Resistant cuttings for stocks should be of sound, healthy wood, from 15 to 18 inches in length, and about the thickness of a lead pencil on the average. The scions which are to be grafted on these cuttings must be from wood of the same, or as near the same, size as possible, so that the neatest and most secure union may be obtained.

The cuttings both for stocks and scions should be as fresh as possible. This is particularly important in our dry atmosphere. It is not necessary to cut each morning the wood to be used during the

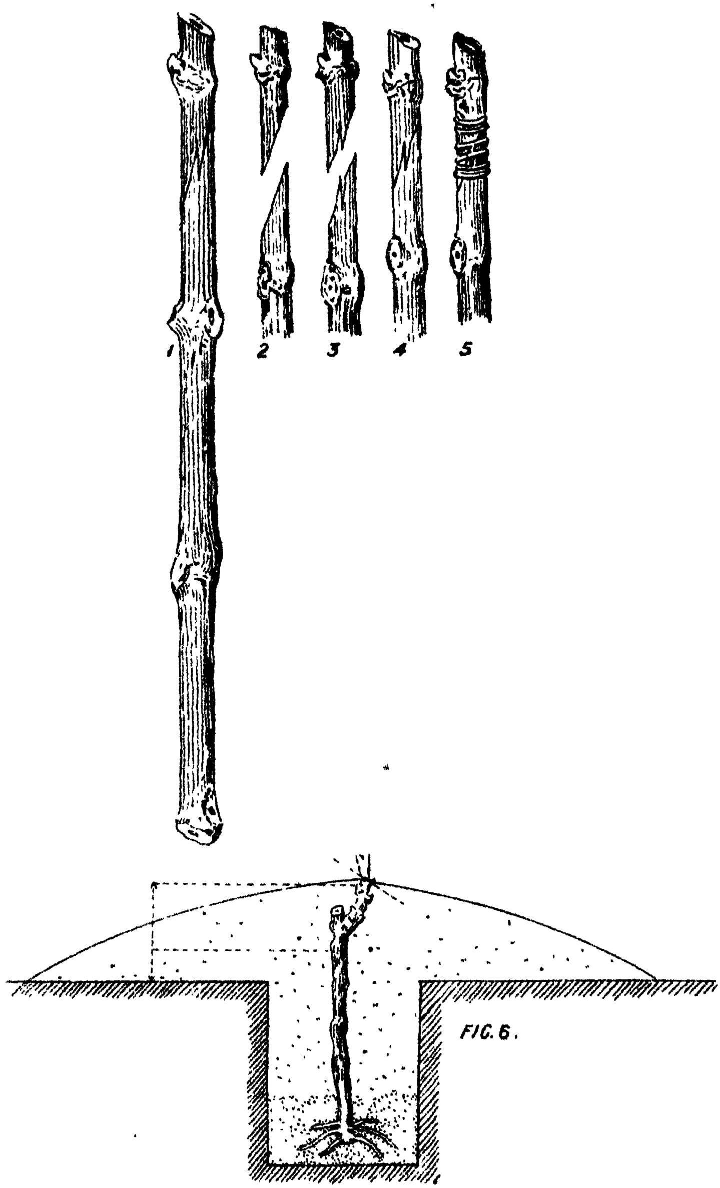


Plate 68. **Grafting of Vines.**

day, but cuttings should not be more than a week old, if the best results are to be obtained. In case they are to be purchased and sent from a distance, they may possibly arrive in a partially dry condition. In such a case the bundles should be immersed in cold water for a day, and might then be taken out and laid in sand or light soil until wanted for use, and they should not be kept this way too long.

Although there are several methods by which the actual grafting is done, it is felt, if the simplest and best is shown, that sufficient information will be given; and this is perhaps better, as the illustrations given are taken from a bulletin from the University of California, the opportunity of securing photographs of them in this Colony not having occurred.

The scions and stocks being ready to hand, the first operation is to remove all the buds from the stock by cutting them closely off with a sharp knife, allowing the bottom of the cutting to be just below an eye, as in the illustration (fig. 1). The object in doing this is to prevent future suckering or throwing up of growths from underground, which would otherwise arise were these buds allowed to remain. Experience shows that with all the care one may take there is still a chance of this suckering occurring.

The next part of the process is the cutting of the stock and scion in order to form the union. For this purpose the stock is taken first and cut at an angle somewhat as shown in fig. 2. A slit is made as shown in fig. 3. The scion is taken with one or two buds on and cut in a similar manner (fig. 3); they are then joined by pressing them together and fitting in the slits (fig. 4), and finally wrapped round with raffia, as in fig. 5.

In some countries it is customary to get a large number of scions cut ready for placing on a corresponding number of stocks. This is not suitable in the Transvaal; the best work can be done by taking both and cutting them as required. Care should be taken in case the scion and stock are not exactly the same size, which in practice often happens, that one side of the union is made in such a manner as to bring the inner bark of both stock and scion into direct contact.

The wrapping with raffia is a precaution, as, were this not done, in the handling of the grafted stock—which is bound to take place—the joint might be seriously interfered with. For the best work, the raffia should be soaked a while in water, so that it is supple and wraps easily. Occasionally a weak solution of sulphate of copper is used, but for the method of handling described here this is scarcely necessary.

Any wrapping may be used instead of raffia, but the writer has found this the best, as it rots away when placed in the ground and so saves the trouble and labour of going over the grafts to cut the ligatures, which would be necessary if string or tape were used.

At the close of the grafting work; sufficient time must be allowed for the work done each day to be planted. Do not carry over grafted stocks from one day to another; get them in the ground the same day.

They should be planted in a good medium soil, not too poor and not over-fertilized. Future success of a vineyard depends to some extent upon the young vines being moved from a poor soil to one rather better. Should vines be removed from the rich soil of a nursery to a much poorer one, it takes a considerable time for them

FIG. 1

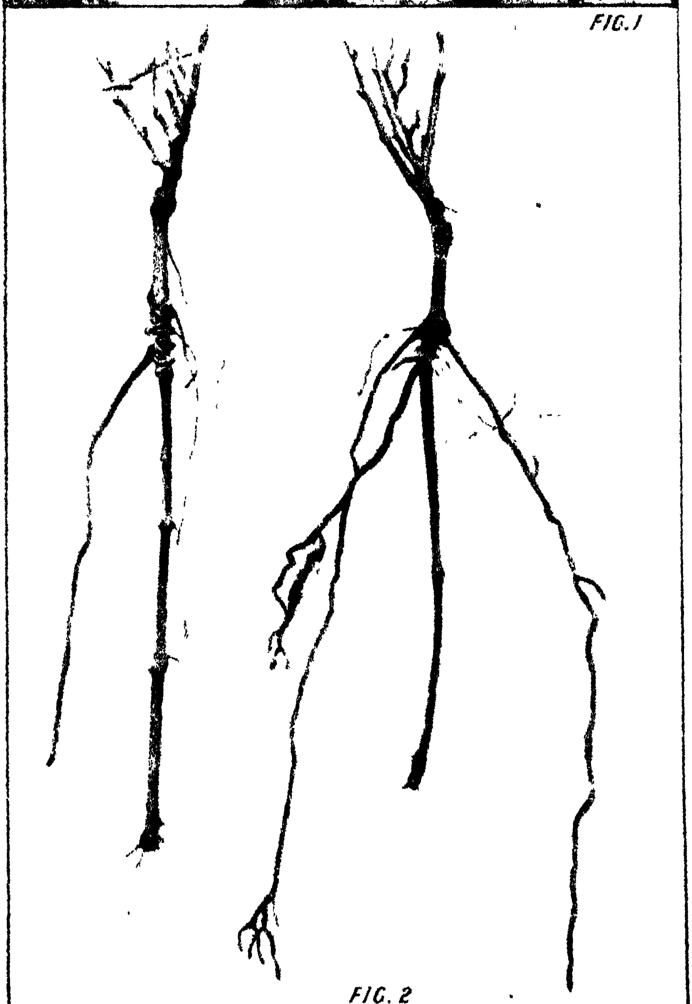


FIG. 2

Plate 69.

Irrigation and Root-pruning of grafted vines.

to become reconciled to the change, and for that reason over-fertilization is not advised, even at the expense of missing a somewhat luxuriant growth in the nursery. Rows should be 2 feet apart, with the young grafts planted about 6 inches distant from each other in the row. This is the custom best adopted for hand cultivation and for nursery work on a somewhat small scale, such as we may expect in the Transvaal. If, however, long rows are to be planted and large numbers of vines grown, it becomes necessary to alter matters somewhat; rows should be 3 feet 6 inches apart to admit of the use of a small cultivator, and vines may be placed a little closer, say, 4 or 5 inches apart.

Nursery soil should be fairly deep, and should also have been at some time trenched. If it has been trenched a year previous to planting so much the better; it will by that time have attained a certain degree of compactness which would otherwise be lacking The grafts may be planted with a spade. A trench is opened and the grafts laid in at distances mentioned. Care should be given to see that the rows are perfectly straight, and the union of stock and scion on about a level with the top of the ground. Then the soil is replaced and firmed, and the scion-part of the graft which is exposed above the ground is completely covered with loose earth to about an inch in depth. The nursery then shows a succession of ridges, and it is in the furrows between the ridges that water must be led when irrigation is needed (Plate 69, Fig. 1). The first water should be given immediately after planting.

The best month for grafting in the Transvaal is July, especially in the warmer parts of the Colony. In August the buds should begin to swell, and the greatest care must be taken to keep the tops of the ridges loose so that the young leaves may be able to push through easily. Some nurserymen allow the tips of each scion to be exposed so that they may know just where to look for the new growth. Soon the leaves begin to assume a nice healthy colour, and the young vines put forth growth. When these growths are about a foot long or more, it is advisable to examine the grafts in order to remove any roots which may have been thrown out from the scions themselves. These must be removed, or they will continue to grow and sustain the vine at the expense of the resistant root, as in Plate 69, Fig. 2. Such vines, should the roots not be removed, are, of course, non-resistant and useless. At the same time that this work is going on a look-out should be kept for any raffia ties which have not rotted, and these removed with one slit of a knife. After cutting the roots of the scions, etc., the soil should be gradually levelled, thus allowing the union to harden off and preventing the throwing out of further roots from the scion.

As a matter of course the nursery must be well looked after and kept free from weeds at all times. After each irrigation, the need for which will be apparent in each individual case, and for the frequency of which no rule can be laid down, the land must either be raked over or (if on a large scale) cultivated. This is one of the most important facts to remember, both in nursery work and in all other connected with fruit trees and vines; *after irrigation comes cultivation.*

The young grafted vines from the nursery should be ready to lift in June. They ought to be carefully examined, and any with

imperfect unions, or any other blemish, should be destroyed. In order to prepare them for planting, the roots are cut back to possibly 3 to 4 inches in length if the vines are to be planted in holes, and to a greater distance if to be planted with a spade; the top is cut back correspondingly to a couple of eyes, and, unless it should be an exceptionally vigorous specimen, only one branch is left. After grafted vines are planted out in the vineyard they require protection, and for this, and to prevent "drying out," the vine is covered with soil in just the same way as it was in the nursery. The tip of the scion only is left in sight so that one may know where to expect the leaves to shoot out (Plate 68, Fig. 6). The soil in these heaps should be kept loose in the neighbourhood of the scion, and if a crust forms after the rain it should be broken. Later on, when the young grafts have started and are growing vigorously, further attention must be given in order to see whether or not roots have again started from the scion. If so, they must be ruthlessly cut off, as, if allowed to remain, they would in time form the main support of the vine, which, no longer being resistant, would then be of little use.

The question has been raised, "Is it wise to plant a vineyard with resistant vines immediately after digging out badly infested stocks?" The answer is that, given stocks with an immunity almost absolute, represented by the figure eighteen out of a possible twenty, there is no danger from *Phylloxera*, and replanting may take place at once. If such a stock as the Jacquez is used, then there is grave danger, and it should not be planted.

Naturally, land on which vines have been standing for some years becomes impoverished to a great extent unless fertilizing agents have been resorted to, and in replanting land so cropped recourse should be had to the use of commercial fertilizers to balance as nearly as possible the requirements of the vine. A crop of velvet beans or other legumes may be planted out with advantage on land from which phylloxerized vines have been dug. The beans should be ploughed under when in blossom; this, for the Transvaal, is one of the best ways of preparing the land for future use, as it affords a good supply of nitrogen and humus, both of which items are scarce in nearly all vine soils in the country.

II. ONION CULTURE IN THE TRANSVAAL.

By R. A. Davis, Horticulturist.

One would suppose from the quantity of onions imported into this Colony every year that there was some insuperable difficulty about producing them within our own borders. That such is not the case can be vouched for by the comparatively few growers who have been able to devote sufficient time and attention to raising this most profitable crop. It would seem that lack of enterprise more than the want of a market is answerable for our large imports.

These lines are written to point out the best way of handling an onion crop from start to finish, and it may be said at once that there is no great secret to be told, as the onion treated reasonably well is easy to grow. Five things are indispensable; they are:—Suitable soil; good seed; irrigation water; the necessary fertilizer; work, i.e. clean culture.

Soil.

There are few soils which will not grow onions of some value, but the plant thrives best on a light sandy loam, in some cases doing well on a soil so light as to appear to be all sand and no loam; such are to be found sometimes in our "vleis," and when these occur there is usually a rich addition of humus from the accumulation of years of decomposed vegetable matter; such a soil is as good as can be found, provided always that one can drain it, for although the onion requires a good amount of water in South Africa, stagnant or standing water is fatal. The presence of a damp patch in a field of onions can always be noticed by the lighter colour of the tops giving such patches an unhealthy appearance. So the need of well-drained soil is imperative.

It has been stated that light soils underlaid at the depth of a foot or so by a layer of pot-clay make an excellent onion field; that is quite true, but in such a season of rainfall as we have just experienced the fate of an onion crop grown under such conditions would not be difficult to foretell. When planting on such lines is undertaken it should only be attempted after deciding positively that it would be an impossibility for the field to get waterlogged—in other words sloping land would be a necessity.

It is not wise to plant onions on land which has been newly broken up. It is on land of this nature that the bulbs often-times fail to develop properly, a fault which has been noticed by the writer especially in the Transvaal; this may also be attributed to bad seed and to undrained soil. Land which has been worked for a few years is best suited for onions, and if, the year before devoting it to that purpose, a weed-smothering, nitrogen-producing crop such as cowpeas or kaffir beans is grown and ploughed under when in bloom, the result will be twofold: A clean soil, fairly free from weeds, and one containing already sufficient nitrogen to obviate the necessity of applying the nitrate of soda dressing mentioned below.

Manure.

In addition to being light, the soil should be also rich, and nine times out of ten will need plenty of manure. For this purpose good, well-rotted stable or kraal manure is well adapted, and may be applied with a liberal hand, if possible the season before planting onions. Where there is a difficulty in procuring animal manure recourse should be had to commercial fertilizers. The following is a complete one for onions:—

300 lbs. basic slag	per acre.
150 lbs. muriate of potash	
150 lbs. nitrate of soda	

It should be applied by mixing the basic slag and muriate of potash, scattering this broadcast over the land and ploughing it under a couple of weeks or so before planting takes place. The nitrate of soda may be applied after the young plants are well started; it may be sown between the rows and raked in.

Seed.

As has been stated, good seed is indispensable, and growers are advised to purchase from reliable seedsmen rather than attempt to

produce their own. No seed is liable to deteriorate more rapidly than that of the onion. Production of seed which shall be absolutely reliable is almost a work of art, and should be left to those who have matured experience in such matters.

Irrigation facilities must be assured, and the necessary arrangements made for allowing the water to run between the rows; for field culture these should be at least 15 inches apart. It is customary throughout the whole of South Africa to sow onion seed in beds and transplant when the young plants are from 6 to 8 inches or more high, and this method has much in its favour. The seed beds are easily looked after and weeded, and the onions grow and ripen more quickly after transplanting than they do under the old style of treatment, which consisted in sowing seed in the rows in which the onions were to grow and hoeing out where the plants were too thick.

Seed beds should be made not more than 4 feet wide, so they may be easily weeded from either side. Length is immaterial. Soil for seed beds should be fairly rich, but not excessively so, or there will be some delay in starting growth when the plants are set out on poorer land. In order to facilitate drainage the ground should be raised 6 inches or more above the level of the surrounding land, and before sowing, a light dressing of powdered blue-stone and white lime in equal proportions should be applied. This acts as a fungicide, and may do away with any necessity for spraying with dilute bordeaux mixture later on.

When the young plants are strong enough it is time to think about removing them to their permanent position; by the time transplanting takes place the soil of the future onion field should be ready and in first-class tilth to receive them. There must be no mistake made about getting the soil ready; it has to be done systematically; deep ploughing, two or three harrowings, rolling if necessary; the surface must be fine and smooth.

Plant in rows 15 to 18 inches apart and from 6 to 8 inches in a row; water after planting, and, when needed, give enough but not too much on each occasion (experience will soon tell you the right quantity). Keep the whole absolutely free from weeds even if you have to keep hands at work all the time; you cannot grow onions and weeds together in the same plot.

When the bulbs have swollen and the plant begins to show some signs of maturity, the tops should be broken down by walking along the rows and treading them down with the foot; this is the simplest and quickest way of doing it. This allows what extra growth there is to go into the bulb and not to the tops of the plant, and helps the bulbs to size up considerably.

When fully ripe the crop is pulled and allowed to lie in small heaps in the sun for a day or two to dry off; then the bulbs are topped and the onions are ready either for market or storage. Storing onions may be on occasion well worth while, and may cause them to realise 50 per cent. more than if the crop were sold immediately after lifting. On the other hand, after a wet season the keeping qualities are none too good, and it may pay better to place them at once on the market. This is a matter which individual growers

must study for themselves, as is also the time for sowing seed, transplanting, etc. No hard and fast rule can be laid down in a country with such variations of climate in the different districts as exist in the Transvaal. The onion takes from six to seven months to mature from seed to the perfect bulb, and is generally sown during February, March, and April for transplanting in the latter part of May and June. Seed may also be sown in July, August, and September.

III. WARNING TO ORANGE GROWERS.

By R. A. Davis, Horticulturist.

The abnormal rainfall of the present season has been looked upon by some growers of oranges as a great boon, in that, even at this season of the year, fruit is in many cases larger than it has previously been in the month of June. There is no doubt but that this is the case, but it must be remembered that soft, watery fruit has but poor carrying qualities. Therefore, where fruit is grown for export, it will be well for growers to give special attention to their trees, and even more to the land in which they are standing. Soil which is too wet is not only bad for the fruit, but also for the trees; therefore growers must set to work and clean up all weeds, grass, and undergrowth from their plantations, leaving them clean so that the air may circulate freely. A dank, weed-grown orange orchard can only produce fruit subject to attacks from many kinds of fungus troubles, and liable to "break down" on a trip from the Transvaal to Europe. The soil need not be ploughed deeply, but a light ploughing will be of benefit; it should afterwards be harrowed and kept with a thin mulch of loose ground throughout the picking season. Where necessary, drainage must be undertaken to carry off surplus water, whether on the surface or in the soil.

All windfalls and rotten fruit should be picked up at least twice a week and dealt with summarily. Windfalls may be of use for local markets, but all rotten fruit must be destroyed by burying.

It will be recollected that towards the close of last season the Transvaal was compelled to place very close restrictions on the import of citrus fruits from Cape Colony and Natal. This was with a view to preventing the import and spread of a particular form of fungus disease commonly known as "blue mould," which up to the present time has been largely absent from this Colony.

Unless the above suggestions are carried out in their entirety we shall be giving this particular pest, besides others, every possible encouragement, and our growers—in sending their fruit even to local markets—will find that if it is affected with this fungus disease it will be rejected and possibly destroyed, as no discrimination can be made in their favour.

Further, instructions will be given to the inspectors at the various packing houses to reject fruit for export from groves which they know to be in an unhealthy condition. This is in order that the high standard of Transvaal citrus fruits may be maintained in

the European markets, and it would be manifestly an act of gross injustice to allow one shipper, who is too lazy to take proper care of his orange trees, to endanger the whole of any consignment in which fruit from his trees might be included.

If the Transvaal is to become an orange-exporting Colony, it is the duty of all growers to pull together and do the best they can to make the business a success, and this can only be done by each individual making a study of his trees and devoting his time and energy to keeping them as they should be kept.

If this is done, the success of our export of citrus fruits is placed beyond doubt. If it is not done, all the efforts of the Government in endeavouring to build up an industry which will be of untold benefit to our farmers will have been in vain.

The Forestry Section.

I. CHARCOAL MAKING.

By C. E. Lane Poole, District Forest Officer, Woodbush.

The method generally employed in this country is of the crudest kind. A hole is dug in the ground to a depth of three to four feet; dry twigs and branches are thrown in and lit. As soon as the branchwood has been reduced to embers a small quantity of wood is thrown in and allowed to burn up well; then more wood is added and allowed to burn up, and so on till the pit is full. The mouth of the pit is then covered with green branches, mud, and sods. The charcoal takes about twenty-four hours to cool, when the pit may be opened and the charcoal removed. This method is very wasteful. To quote W. R. Fisher: "Such a method is only justifiable when wood has hardly any value, as almost free admission of air is involved."

European methods of burning charcoal are described in all technical forestry works,* but as these are not always within the reach of the makers and consumers of charcoal, I will give a description of the most simple method used in Europe.

Charcoal may be made from any species of tree; the wood should be sound and air-dried. Rotten wood is useless for the purpose, and air-dried wood answers better than dead wood.

The species should not be mixed: only one kind should be burned at a time. The billets are cut into short lengths, 18 inches to 3 feet, so that they may be carefully packed: the shorter the billet the more easy it is to form the kiln. All pieces over $2\frac{3}{4}$ inches in diameter must be split into small pieces; logs over this diameter take too long to burn. Very crooked branches should be cut into very short pieces. The straighter the billets the more easily is the kiln packed; the short pieces may be all used for filling up interstices.

The sizes of the kilns vary a great deal, though one holding between 30 and 40 cubic metres (1,000 to 1,400 cubic feet) answers best. The shape of the kiln being a paraboloid, the girth will be between 65 and 75 feet. The volume of a completed kiln may be given sufficiently accurately by the following formula:—

$$V = \frac{g^2}{\pi^2} \times \frac{\pi}{4} \times \frac{h}{2} = \frac{g^2h}{8\pi} = \frac{g^2h}{25\cdot13}$$

g = girth. h = height.

It is very important that the site of the kiln should be sheltered, level, and near to water. In the French forests, charcoal burning is restricted to one portion of the forest, so that a large number of kilns are generally found together.

The ground under the kiln has an influence on the rate of burning. The soil should not be too light nor too heavy. In the former case too

* *Vide* Schlich's "Manual of Forestry," Vol. V; G. Huffel, "Economic Forestiere," Tome I; A. Mathey, "Traité D'Exploitation Commerciale des Bois," Tomes I and II.

much air comes through, in the latter too little. The best site of all is where charcoal has already been burned several times; the mixture of soil and charcoal dust allows the right amount of air to come through. Next to an old site, a sandy loam is the best, as it allows sufficient air through and also absorbs the moisture from the burning kiln.

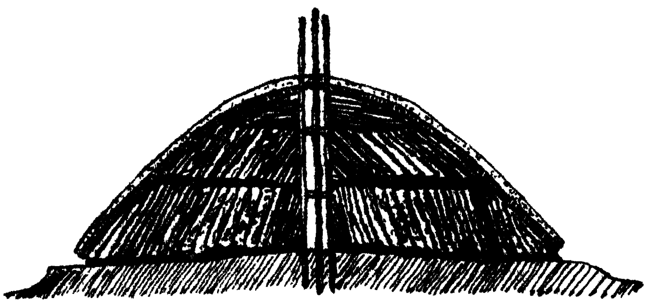
The site being chosen, the ground must be prepared in the following way:—The ground must be dug over; all grass sods, stones, large roots, etc., removed. A peg is then fixed in the centre and a circle described, and the ground given a slope from the centre to the circumference. The degree of slope depends on the hardness of the wood to be burned and the stiffness of the soil. If the ground is raised one foot at the centre it will be found sufficient. The site is then stamped down, and remains unused for some months, generally for the winter. Before stacking the kiln the ground must be dried by kindling dry brushwood on it.

The kiln is erected as follows:—Four poles are driven into the site at the centre, and form the flue. The poles should be one foot apart, and bound with withes to form a hollow cylinder. The flue is then filled with very dry shavings, branchwood, etc. This highly combustible fuel should be put into the flue quite loosely. Very thin pieces of wood must then be packed round the flue, and all spaces filled with shavings. Around the flue thus made are packed two tiers of billets, the thinnest billets are placed next to the flue, then the larger ones, and last of all the smaller ones again on the circumference. Both lower and upper tiers are packed in the same way. When the lower one has been started, work should be begun on the upper one, and both tiers continued together until the full circumference of the kiln is reached.

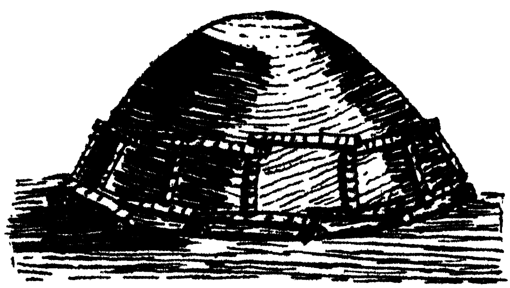
The billets should be placed as vertically as possible with their thick ends down. This will give the necessary slope to the outer wall of the kiln, between 60 and 70 degrees. The top of the paraboloid is completed by packing short pieces of very dry wood on the upper tiers of billets. All holes and crevices must then be stopped with split pieces of wood to prevent too great a draught and to save the covering from collapsing.

The kiln is now charged. Before it can be lit it must receive two coverings, an inner and an outer one, and two supports for these coverings, termed the lower and upper supports. The lower supports are generally made of forked pieces of wood driven into the ground all round the circumference. Stones at short intervals, with split pieces of wood joining them up, will do as well. Iron supports are used in some districts, shaped like circular segments with a prop at one end of each piece; these are very durable. The upper supports form a similar circle higher up.

The inner covering is made of leaves, moss, sods, and green branches. The covering is done from the top down. The outer covering is made of wet "daga," viz., clay and water mixed to a thick paste. Charcoal dust, mixed with the "daga," gives it the right consistency. What is aimed at is a covering dense enough, but not so dense as to become hard with the heat; it should remain soft so as to yield to the sinking of the burning kiln and to allow the steam to escape. The outer covering is begun at the base when



SECTION OF CHARCOAL KILN. Showing method of packing.



COMPLETED KILN. Showing upper and lower supports.

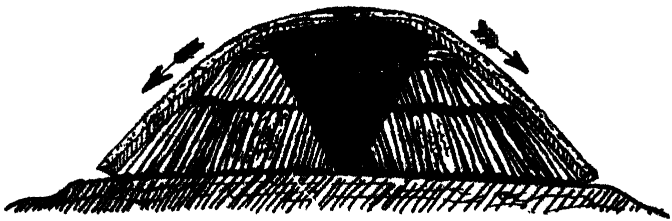


Plate 70.

BURNING KILN. Showing progress of carbonisation.

From Schlich's "Manual of Forestry," Vol. V.]

the upper supports are placed over it, and it is continued up to the top. The thickness of the covering varies, being about 1¼ inch at the top and 2¾ inches at the base. If the site chosen is not in a very sheltered position, a wind-break should be erected with branches, etc., as high as the kiln itself.

The kiln is always kindled before dawn on a still morning. Fire is applied to the top of the flue, care being taken to leave the kiln open under the lower supports. The flue, once well alight, will set fire to the adjoining billets; the fire gets well hold of the billets at the top of the kiln. There is some danger at this period of the kiln bursting. If the burning is observed to go too rapidly, and that a large amount of steam is being found, the open spaces below the lower supports should be closed.

After a short time the smoke becomes pungent, which shows that the kiln is well alight and that charcoal is being formed. It is very important, at this stage, that the burning be kept at a regular pace. Charcoal is formed at the top first in the shape of an inverted cone. The draught should be carefully regulated so that one side does not burn faster than the other. The spaces under the lower supports may be left open if more draught is required, but as a rule directly the charcoal begins to be formed these spaces are closed up. In order to regulate the burning, on the second or third day two rows of holes are knocked through the two coverings. These holes should be about two feet from the top, and on the leeward side. At first a mixture of smoke and steam comes from these holes, but, as the fire comes nearer, the smoke becomes clearer and more pungent. The upper row of the holes should then be closed with wet "daga," and another row of holes opened below the second row. By this means the burning is regulated; the burner knows exactly how far down his kiln has burned; he opens his last row of holes below the lower supports, and when flames come out then the burning is completed. During the burning great care must be taken to remedy all hollows and patch up all cracks.

A hollow is likely to form at the top of the flue. Also through bad packing or wet wood hollows may form in other parts of the kiln. Were these hollows to be left unfilled two things would occur, (1) the covering would fall in and the kiln would burst into flame, (2) the hollow would cause a draught in that part and make the burning irregular and reduce the yield in charcoal. The hollows must be filled at once with short pieces of wood or charcoal. When a marked depression is noticed in the covering of the kiln, all vent-holes should be closed, and wood and material for filling and covering the hollow collected by the burner.

After the kiln has been closed for about two hours the covering over the hollow must be removed, the contents pressed down with a piece of wood, and the hollow filled. The place must then be re-covered with green branches, etc., and "daga," and beaten down firmly with a shovel. The flue, which burns away at once, must be filled in the above manner the first evening. This filling has often to be repeated every evening for four or five days.

Care should be taken, by burning very slowly and carefully, to reduce the number of fillings to a minimum. The loss of charcoal caused by the filling of hollows is great—not only is the charcoal

pressed down and broken, but the opening of the covering causes a draught and the charcoal around gets burned. Every evening the burners should fill up the cracks in the covering, effect any fillings necessary, and if the weather is stormy close up all vent-holes. Also, every evening that portion of the kiln where charcoal has already been formed should be beaten down and covered with wet daga.

All through the process of burning the burners should take turns to watch the kiln, especially at night. In France several families divide the work of looking after a large number of kilns.

Once the wood is entirely carbonised, which is shown by flames coming out at the bottom of the kiln, wet daga must be applied all over, and all holes must be stopped. After twenty-four hours the burners remove the covering in strips, and apply fresh earth to the glowing charcoal. This cools the kiln quickly and extinguishes all fire.

The charcoal may be removed twenty-four hours after. This work is always done at night, when flames may be more easily seen. It takes several nights to empty a kiln, as only a small quantity can be taken at a time. The burner, armed with a long-toothed iron fork, opens the kiln on the leeward side, and removes as much charcoal as he can without setting the kiln in flames. The kiln is then opened at another point, and so on all round, care being taken to fill up the hole with earth before opening a fresh one. In this way all is taken out except the fine charcoal at the centre, which is raked out along with the earth and ashes; these serve for covering the next kiln. The charcoal removed from the kiln is put to one side and watered. Once cool, it is sorted out according to size.

In the above description of the commonest method of charcoal burning—taken almost entirely from Schlich's "Manual of Forestry," Volume V—I have not gone into the question of what species of tree yields the best wood for making charcoal in this country. In Europe charcoal is made chiefly from coniferous woods. The average yield in volume for coniferous woods is 60 per cent., while for broad-leaved woods it is 50 per cent. The yield by weight is approximately the same for all woods, about 25 per cent.

The following table, from Van Berg's "Anleitung zum Verkohlen des Holtzes," shows that though coniferous woods yield a higher volume than broad-leaved woods generally, soft broad-leaved woods yield a higher volume than hard woods, such as oak or beech. Branch wood and round wood yield less than split wood.

Beech or oak (split billets) ...	52-56	20-22
Birch (split billets)	65-68	20-21
Scotch pine (split billets) ...	60-64	22-25
Spruce (split billets) ...	65-75	23-26
Spruce (stump wood)... ...	50-65	21-25
Spruce (round billets) ...	42-50	20-24
Spruce (small branch wood)...	38-40	19-22

In this country coniferous woods are poorly represented, but the common hardwoods apparently yield a good return.

Fortunately, experiments have been conducted at the Cape in connection with the use of charcoal for suction gas-engines, and the

results will be found in an article by Mr. F. B. Parkinson, Assoc. R.S.M., F.R.G.S., in the *Cape Agricultural Journal* for December, 1908.

Experiments were conducted with three species—two indigenous and one exotic. The two native species were the common kaffir thorn and karee, while the exotic was the equally common and prolific willow. The conclusions arrived at were, briefly, as follows. The relative volume of charcoal, taking willow as unity, were:—Willow 1.0, kaffir thorn 0.688, karee 0.683.

Instead, however, of willow charcoal having to be fed one-third faster into the producer of the suction engine, owing to its greater volume, it was found to be consumed only a little faster than the hard charcoal. This was explained by the analysis as follows:—

For Willow—

Total water	6.6
Volatile matter	4.38
Carbon	85.5
Ash	3.52
	100.00

For Karee—

Total water	7.8
Volatile matter	22.2
Carbon	66.92
Ash	3.08
	100.00

Willow charcoal was found to be 20 per cent. better, weight for weight, than the others, so only had to be fed 10 per cent. faster.

Mr. Parkinson further points out that "there are additional advantages for willow, in that it only requires half the labour to cut and prepare for charcoal making, and that it is one of the quickest-growing trees and is easily propagated from cuttings."

Mr. Parkinson goes on to show that charcoal is preferable to anthracite for use in suction gas-engines, and concludes his most interesting article by saying:—"Taking the present state of things, it is perfectly safe to say that where anthracite costs £3 per ton, there charcoal is worth £3 10s., at least for irrigation purposes, and more still in towns where power users are desirous of eliminating the evil odours that are unavoidable for the few minutes when blowing up for a start. But it may interest some that the smell while running may be got rid of by passing the exit scrubber water through a barrel of hardwood charcoal. Seeing the enormous amount of timber within easy reach of the railways that is of no value for other uses, it may safely be predicted that a considerable charcoal industry will spring up in the near future."

It is to be hoped that a less wasteful method than that of burning charcoal in pits will be employed. The kiln method is slower, but the yield is so much greater, and the quality of the charcoal so much higher, that the two methods do not admit of comparison.

The Tobacco Section.

I.—CENTRAL TOBACCO WAREHOUSE, PRETORIA.

By J. van Leenhof, Chief of Tobacco Division.

As it has now been decided to erect a central tobacco warehouse on a site kindly set aside by the Railway Administration at Pretoria West Station, adjacent to a siding there, it may be of some interest to readers of this journal to know something about this new building and the work it is proposed to carry out therein. At the outset I may say that it is hoped the building will be in course of erection when this article appears.

The situation is considered an ideal one. Being in Pretoria it is in the centre of the Colony, and will be convenient to all tobacco-growing districts, more especially so to the Districts of Rustenburg, Waterberg, and Zoutpansberg. It will be in direct communication with the eastern line to the low veld, serving such Districts as Middelburg, Lydenburg, and Barberton. Tobacco from Piet Retief will be forwarded via Volksrust or Ermelo, and consequently a district receiving-depot in the town of Piet Retief will be indispensable. Such a depot will facilitate the transportation of tobacco, and thereby lessen the cost of production.

Plate 71, figure 1, shows the plan of the central warehouse. The building is 286 feet long by 60 feet wide, with a platform 10 feet wide abutting on to the railway siding. As will be seen, the building consists of two small offices 20 feet by 16 feet, a receiving-room 60 feet by 43 feet, reordering-room 60 feet by 43 feet, sorting-room 74 feet by 43 feet, two drying-rooms 24 feet by 17 feet, reordering machine-room 100 feet by 16 feet 5 inches, packing-room 60 feet by 42 feet, and a storeroom 60 feet by 42 feet.

On account of the fact that the sum voted for the warehouse is limited, no provision has been made in this building for the fermentation of leaf tobacco. However, in the workrooms of our office we have made temporary provision for this work. It is to be hoped the Government will shortly set aside sufficient funds for the addition of a fermenting-room to the warehouse; also funds for the enlargement of the warehouse to enable us to handle the whole of the tobacco crop of the Transvaal.

The principle of the building is this:—The tobacco coming from the planter in its raw state is received in the receiving-room, and in due course, after treatment, it leaves the storeroom properly packed in bales and labelled. The leaf will be packed in such a way that the manufacturers may leave it in the bales for years, if necessary, without risk of the tobacco becoming damaged. Furthermore, the dealer or manufacturer will be enabled to obtain exactly the class and quality of leaf he needs for his particular purpose, and consequently he will be prepared to pay a higher price than he can afford to do under present conditions.

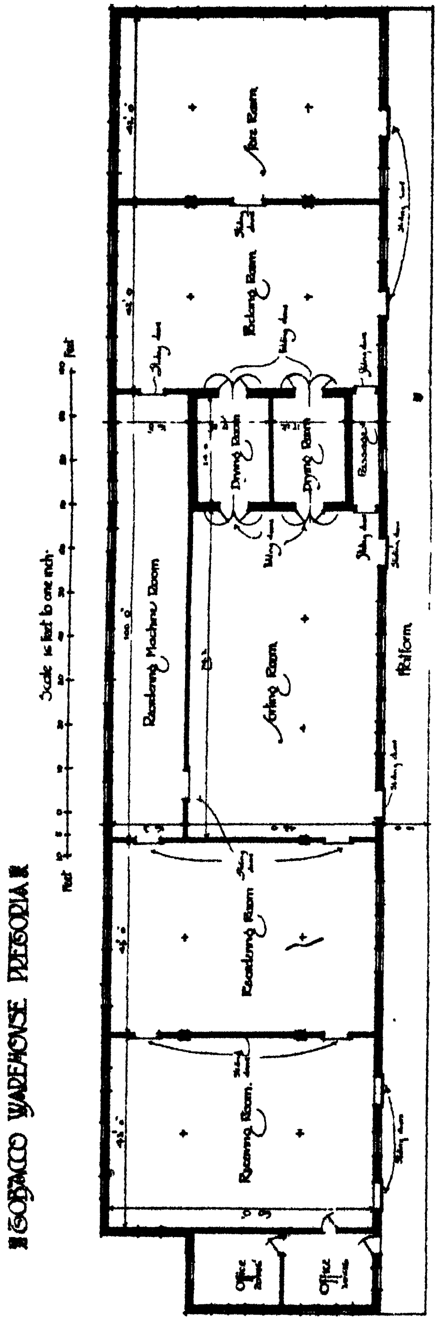


Fig. 1. Plan of Central Tobacco Warehouse, Pretoria.

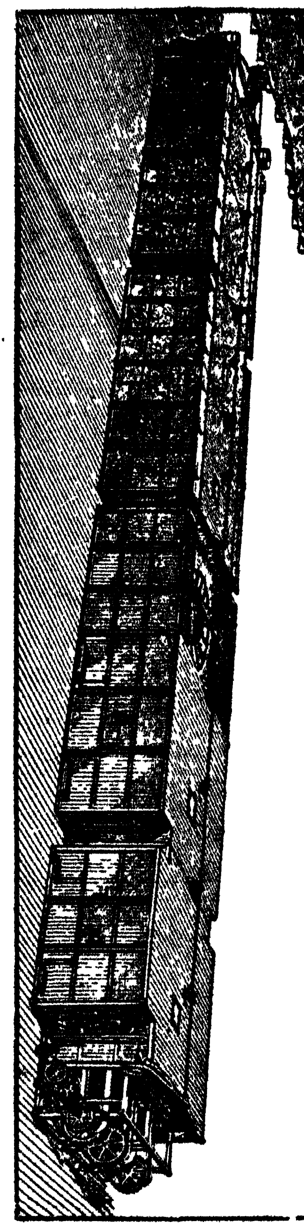


Fig. 2.—Exterior of a large re-ordering machine.

Plate 71.

Fig. 1

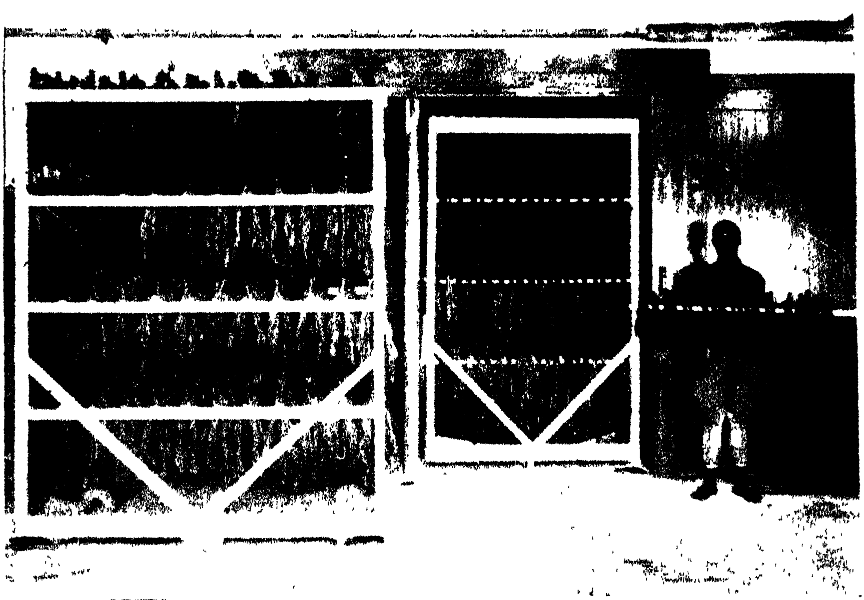


Plate 72 Fig. 2.

Fig. 1 Classifying tobacco, boy at right sorting leaf into sizes.
Fig. 2 Trucks loaded with laths filled with sorted tobacco sized and bundled ready to go in the drying-room

Tobacco Workrooms, Pretoria.

Fig. 1

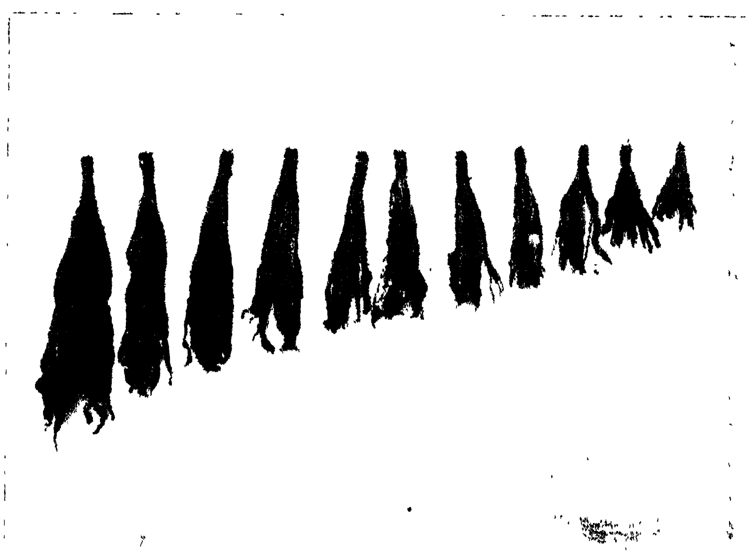


Plate 73. Fig. 2.

Fig. 1. A new receptacle for sizing tobacco leaf.
Fig. 2.—Tobacco sorted into sizes.

Tobacco Workrooms, Pretoria.

Fig. 1.—Field of selected bright tobacco, Rustenburg Tobacco Experiment Station.

Plate 75.

Fig. 2.—Field of selected tobacco, Barberton Tobacco Experiment Station.

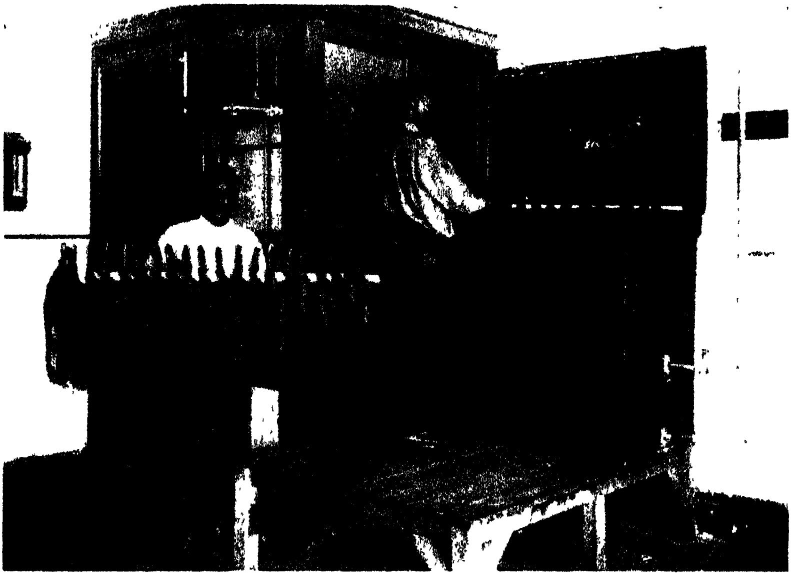


Fig. 1.

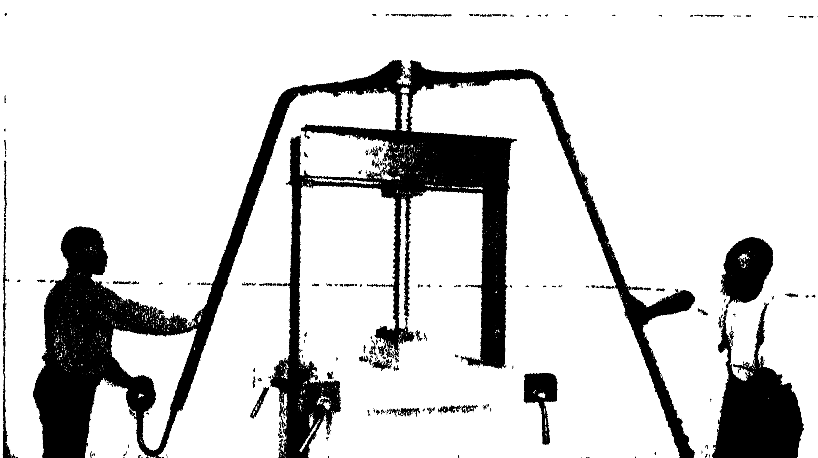


Plate 76.

Fig. 2.

Fig. 1. —Moistening tobacco in steaming box.
Fig. 2. Tobacco baling press.

Tobacco Workrooms, Pretoria.

The warehouse management will guarantee that the mark on the bales represents the sample which has been offered him. Of course various manufacturers need different kinds of tobacco, and if it is possible to obtain the exact article—necessitating no waste—it is readily understood that the product is of more value than is the case at present, when a certain proportion of leaf purchased has to be discarded as useless for certain manufacturing purposes.

Many other advantages will accrue from the establishment of a central warehouse, i.e.

(1) Tobacco planters will co-operate, and therefore they will be less dependent upon the middleman.

(2) From the sales it will be seen at once for what kinds of leaf, and which class, the largest demand exists, and this knowledge will enable us to recommend the production of such kinds and classes in suitable localities.

(3) The tobacco industry of the Colony will thereby be placed on a sound basis. The production of good leaf will become gradually cheaper, and this will enable us to better supply the local market and afterwards create an export trade.

Much valuable time was lost before it was definitely decided to erect the warehouse, and therefore I have been busily engaged in getting things into order for commencing this work during the present season, if only on a small scale. Arrangements have been made for handling about 100,000 lbs. of tobacco in our present tobacco workrooms in Pretoria. I do not think the central warehouse will be in readiness to receive this season's crop, and the workrooms referred to will, therefore, be very useful, not only for the treatment of a portion of the tobacco crop, but chiefly to enable us to form an idea of the difficulties we may have to encounter when we treat the Transvaal leaf on a larger scale in the warehouse.

These workrooms are used chiefly for treating the crops from our own experiment stations and for general experimental purposes. They are situated at 434 Market Street, Pretoria, and consist of:—(1) Receiving-room, which can also be used as a packing-room after the tobacco has been treated; (2) combined bulk fermenting, sorting, and reordering-room; and (3) drying-room. There is also ample storage accommodation in the building.

In the receiving-room the tobacco from the farmers' curing sheds is received, weighed, unpacked, and then transferred to the sorting-room, where it is sorted according to body, texture, colour, and length of leaf. It is then bundled into bundles of about twelve leaves. Even when sorted tobacco is received from the farmer it is not in fit condition to be packed away; the leaf is dry and easily crumbles, while at the same time the stems, although apparently dry, often contain sufficient moisture for developing the growth of mould, so that the tobacco when packed cannot be kept long without deteriorating. All unfermented tobaccos, when packed, should be kept at least two years to undergo the process of ageing. This process may be continued for from four to five years, and improves the flavour as well as the burning qualities of the leaf.

There are several methods of bringing tobacco leaf into proper condition, but the two following methods are to be recommended:—(*a*) The so-called "truck system," and (*b*) "machine ordering"—the truck system for handling quantities of less than two to three hundred thousand pounds annually; the machine-ordering when large quantities of tobacco are handled.

Plate 71, figure 2, shows the exterior of a large reordering machine. The machine I would recommend for use in the Transvaal is called the combination machine. It is fitted with endless chains for handling the tobacco on sticks, and there is also an apron for receiving the tobacco. There are also separate machines with chain only, and others with only an apron. When the machine is equipped with apron only it is adapted for dip filler, strips, scrap, and stems, and before the combination machine was placed on the market it was also used for drying bundles on the apron. The latter method, however, was not found satisfactory.

The chain is for handling leaf tobacco in bundles, and sometimes strips are handled after they have been in bundles in order to keep them as straight as possible. In this case it is necessary for the apron to catch any of the strips that might drop from the bundle when passing through the machine. It will be seen, therefore, that the combination machine can be used for all purposes, and is to be recommended for Transvaal tobacco with its different qualities and sizes.

These machines are of different sizes, and one of them, which might be very suitable for our warehouse, has a capacity of over 1,350 lbs. per hour when the leaf is hung on sticks. This machine is 84 feet long, 10 feet 8 inches wide, and 8 feet 6 inches high; carries an apron 6 feet wide and sticks 6 feet long. The approximate price is £700 f.o.r Philadelphia, Pa., U.S.A. Taking a working day as ten hours, and calculating only 200 working days in the year, this machine is capable of handling 2,700,000 lbs. annually. As will be seen, the size of this machine fits the machine reordering-room in the proposed warehouse.

At one end of the machine the tobacco is placed on an endless wire belt which carries it through the different compartments, and finally delivers it to the packers. The tobacco is first carried through two very hot steam-heated chambers to render it thoroughly dry. The temperature of the first chamber is not as high as that of the second. This is to avoid "cooking" the tobacco, which naturally contains more or less moisture. The temperature of the second chamber may be raised to about 160 degrees, but, of course, this depends on the kind of tobacco to be treated. The tobacco passes into a third chamber, where it is partially cooled by a current of air, and afterwards into fourth and fifth chambers, where it is just sufficiently moistened to make it pliable enough to handle. As soon as the tobacco is taken out, and while it is still warm and soft, it is packed. The leaf must feel moist enough to handle without breaking, and yet contain so little moisture that it will appear perfectly dry when cool.

In the tobacco trade there are men who make it their special business to reorder tobacco and pack it for shipment. The manager of a reordering plant may also be a leaf dealer, or, again, he may

only handle tobacco for leaf dealers. We need a man well acquainted with such work to take charge of the handling and reordering of our tobacco in the central warehouse, and I am pleased to be able to state that he is shortly due to arrive here, to take up his duties in this line.

As already stated, our tobacco workrooms in Pretoria are equipped for the fermenting of tobacco as well as ordering and packing by the truck system. Plate 72, figure 2, shows the truck on which racks are built to carry laths filled with sorted tobacco. The trucks are pushed into the drying-room (see truck on right of picture). The drying-room is heated by steam, and when the trucks have been placed therein and the doors closed, the tobacco remains there with the temperature at from 150 degrees to 160 degrees until the leaf is so dry that it will crumble in the hand. After the trucks have been taken from the drying-room they are allowed to stand for from 12 to 24 hours, and are then taken to a steaming-box (see Plate 76, figure 1). The leaf, still on the laths, is placed in this box, the cover closed, and steam turned on for a few seconds. As soon as it is taken from the steaming-box, the tobacco is packed while still soft and warm. It must be noted that the moisture must be such that when the tobacco has quite cooled off again it is dry.

The best method of packing for our purposes is in bales of burlap, and, on account of the many different qualities, it will be found that bales of from 150 to 200 lbs. will be sufficiently large, and small bales are, of course, easily handled. Plate 76, figure 2, is one of our tobacco-baling presses. There are, however, many other presses on the market. The best type would be one provided with two or more boxes so that whilst one box is being pressed another could be packed ready for pressing.

In Plate 72, figure 1, the boys are sorting fermented cigar tobaccos, and also unfermented smoking tobaccos just received from the planters. Two boys on the left, under supervision of a white overseer, are grading leaf with regard to colour, texture, and body. These workers throw out the green, mouldy, and inferior leaves. The boy on the right is sorting the leaves into sizes, after the grading has taken place. For this purpose I have had constructed a box comprised of eleven compartments of different sizes (see Plate 73, figure 1). All that has to be done is to place each leaf into that compartment which it easily fits. The box can easily be made either on the farm or at the factory. For the manufacturers, also, I am sure it will prove most useful.

The leaves are afterwards bundled (each bundle containing twelve leaves) and each class kept separate, after which the bundles undergo the drying, ordering, and packing process as already described. Plate 73, figure 2, shows the result of the sorting into sizes, and it will be easily seen how the length of leaves differs in the same lot of tobacco, and how important it is to keep and bale each kind separate for the manufacturer. This work of sorting into sizes could be performed by the farmers themselves, keeping each class separate as far as possible.

When I arrived in the Transvaal, nearly three years ago, what struck me at once was the fact that the tobacco went from the farmer directly into the hands of the manufacturer without first passing through the proper dealer or handler for the purpose of sorting,

treating, and packing. The manufacturers up to that time were unaware of the necessity, or had no facilities, for carrying out this useful work, and consequently it was often the case that good tobaccos, which could have been used for more lucrative purposes, were only put to ordinary uses; and, on the other hand, it frequently happened that bad tobaccos, which should have been sorted out and kept separate, were used for good brands of manufactured products, resulting in a detrimental effect upon such brands.

Furthermore, many farmers and small storekeepers in the Transvaal are in the habit of cutting up ungraded leaf tobacco which, on account of its bad quality, is useless to regular manufacturers, and selling it as a manufactured article. This stuff, in large quantities, is hawked along the Rand and through neighbouring Colonies, and the sale of it—insufficiently treated as it is—damages the reputation of the better classes of our tobacco products.

It seems to me that the only way to deal with this state of affairs would be by the passing of a law demanding that all tobacco dealers should hold a license, and at the same time to restrict the manufacture of tobacco, even on the very smallest scale, to holders of licenses. If such licenses be granted for the sum of, say, £50 it would decrease the sale of tobacco by small storekeepers and hawkers who sell inferior brands and thus damage the reputation of our tobacco.

To further discourage the production of bad quality leaf by the farmer and to encourage the production of good leaf, which is the only way of creating a good market locally as well as oversea, it would be in the interest of the tobacco industry as a whole, and at the same time be a source of revenue, if the Government were to create an excise duty on tobacco* of, say, 3d. to 6d. per lb. to be paid by the manufacturer as soon as the manufactured product is sold. This tax to be levied on all tobacco grown, whether of good or bad quality.

The passing of such a law would have a far-reaching effect on the industry, inasmuch as the planter would be compelled to produce a good class of leaf—the market for cheap leaf having disappeared. It is my firm opinion that the above measures, if enforced by Government, would do much to settle the tobacco industry on a firm basis.

I am often asked by tobacco planters and manufacturers as to the best means of recording the temperature and relative air humidity in curing-sheds, storerooms, and tobacco workrooms. Therefore the plates in this article, aided by a few words of explanation, are published for the information of those who are interested in the subject. Plate 74, figure 1: A psychrometer (wet and dry bulb thermometer) for measuring the relative air humidity. In tobacco workrooms, especially where the fermentation of leaf is undertaken, an artificial supply of air moisture is indispensable, and this is more especially the case in a climate possessing the dry atmospheric conditions of the Transvaal. In our workrooms this is done by means of steam pipes led through pans containing water. The evaporation can easily be regulated by means of a steam tap affixed to each water pan.

In this room—with the aid of a psychrometer—the amount of humidity can be accurately controlled by noting the temperatures of the dry and the wet bulbs. From an existing table the percentage of

* In Germany, U.S.A., and in other countries similar taxes exist.

the relative air humidity may then be read. When fermenting tobacco leaf this percentage should be kept at about 80 degrees, provided the tobacco is in condition. If tobacco is too moist, there is danger of spoiling the leaf by provoking too quick a fermentation, or through moulds. If the tobacco is too dry, the fermentation will not proceed, and the leaf may be moistened slightly; for this purpose we make use of a fog pump (see Plate 74, figure 4). The fog pump, by means of a very fine nozzle, emits a spray so fine that it has the appearance of fog—the object is to apply as little water as possible. The fog pump is also used to render the leaf pliable should it become too dry to handle in the workrooms.

Plate 74, figure 3, is a specimen of the tobacco warehouse basket used by us. The baskets were made to our order at the South African Women's Federation Basket School, Vrededorp, Johannesburg. The baskets are brought into use when leaf tobacco has to be moved about in the warehouse, and they are found very useful when the different classes have to be set aside in sorting, and by their use the damage to leaves will be reduced to a minimum.

II.—TOBACCO EXPERIMENT STATIONS.

In the preceding issue of this journal (January, 1909) will be found some remarks on the progress of our Tobacco Experiment Stations at Rustenburg and Barberton.

The article in question was prepared in November, 1908, and on page 266, describing Plate 43, figure 1, and referring to the Rustenburg Station, the following appears:—"There is a tendency amongst planters in the Transvaal to over-irrigate tobacco lands, and this has a bad effect on the quality and quantity of the leaf. To visitors in January I would draw special attention to the good growth of our tobacco plants. They received practically no irrigation, except once immediately after transplanting."

In view of this remark, I may say that our lands received no irrigation, and were treated according to my recommendations laid down in Farmers' Bulletin No. 27, "Tobacco transplanting and further treatment in the field." We anticipated a good crop, as a result of our seed selection work* of the two previous seasons. Plate 75, figures 1 and 2, show two fields of tobacco plants of almost perfect uniformity. These fields were not irrigated, and were harvested shortly after the January rains.

In each picture the rows of tobacco plants, clearly seen, consist wholly of progeny plants from one mother-plant; that is to say, the crops were raised from the seed of *one* self-fertilized, selected plant. When we detect an almost perfect plant in the field we take care to have this plant bagged (as explained in Farmers' Bulletin No. 28), and to collect the seed and keep it separate for future crops.

In the front of the picture (Plate 75, figure 1) is seen a "bagged" plant selected for seed production on one of our tobacco

* Tobacco seed selection is fully described in Farmers' Bulletin No. 28, "Breeding and selection of tobacco," which can be had gratis on application to the Government Printer.

fields at our Rustenburg Station. At Rustenburg we have some good, sandy loam soils, and consequently we are experimenting chiefly with bright tobaccos, for which there is an increasing demand. At the time of writing, a first start has been made with the flue-curing of our crops, and although our special assistant for flue-curing has not yet arrived, we still hope to obtain some good results.

Plate 74, figure 2, shows a minimum and maximum thermometer specially made to our order, and used in connection with the flue-curing process. The instrument registers from 32 to 190 degrees, and the scale is specially adapted for the purpose, as the highest temperature in flue-curing reaches 180 degrees. The degrees are clearly marked. In flue-curing the temperature must not be allowed to drop, or to rise, too quickly at certain stages. The needles (above the mercury in the tubes) at once show when the temperature has gone too high or has dropped during the absence of the operator. These instruments can be obtained in the Transvaal at an approximate cost of 10s. each.

Plate 75, figure 2, shows a field of uniform tobacco at the Barberton Station. Here we are paying more attention to the production of heavy tobaccos and cigar tobaccos.

The Dairy Section.

I.—MILK AND CATTLE TREATMENT.

By R. Pape, Superintendent of Dairying.

Milk is a liquid of animal origin containing different bodies in a dissolved, semi-dissolved, or suspended state. The milk of various species of mammals differs considerably in composition, but I will limit myself here to the milk we get from the cow.

In different countries the milk of sheep, goats, and asses is used for consumption or cheese-making, but the available quantity of such milk is always limited.

The composition of cow's milk is not always the same; it varies so much that it is not feasible to fix the same value for all milk. The value of milk varies with the amount of solids it contains, but not all solids have the same value. For the farmer fat and albumen or casein are the main constituents. Milk, sugar, and salts are indispensable components of milk; yet, to the farmer, it does not matter so much whether the milk contains more or less of these bodies.

If the milk contains more fat or more casein, then such milk can yield more butter and more cheese, and the enhanced value of that milk is clear to every one.

Thus it is a matter of great importance to all dairy farmers to obtain not only a large quantity of milk, but also milk of high intrinsic value. For it may come to pass that a small quantity of high-grade milk represents a higher monetary value than a larger quantity of milk of a lower grade. Everybody's interest demands, therefore, the production of milk of the best obtainable quality.

In the following pages I will endeavour to explain how the best milk can be obtained. Theoretical considerations I will omit as much as possible.

Milk Production.

The system of milking exerts a predominating influence on the quantity and quality of the milk. The experienced dairy farmer will give all his attention to the seemingly simple process of milking, as he knows that so much depends on it. I know of a case where the milk of one farm was unfit for cheese-making, and the only cause that could be discovered was wrong milking habits. After rectifying this the milk became quite normal.

Therefore I will give a short description of the correct treatment of a milch cow and the method of obtaining the most and richest milk.

A milch cow should be treated gently; if she is restive during milking then the milker should not be impatient, but speak soothingly to the animal; in fact, just as if she were a child. The cow will grow fond of the milker provided she meets with gentle treatment.

When the cow is calm and quiet during milking she will let the milk flow easily, and a large quantity of rich milk is drawn. But if

the cow is not at ease she will hold back the milk, and, with much trouble, a small quantity of poor milk is drawn.

The intelligent dairy farmer will take much trouble in procuring comfort and ease for the milch cows, for he knows it will pay him to do so. The cow must be in good health, and therefore the skin is kept clean, and a well ventilated, hygienic stand is provided during the stabling period.

Stables for milch cows belong, in this country, still to the desirable things. Yet the building of stables will be found indispensable if milking is to become a very remunerative industry. There is no reason why the Transvaal should not breed milch cattle yielding three to four gallons daily, but then the cattle must get better treatment than hitherto. Good stabling and the growing of winter food are the first requirements.

In the leaflet "Milk Treatment" I compressed the main points for the dairy farmer into rules. I do not intend to explain every rule at length here, but I will return to some points and add to others.

In feeding cows special notice must be taken that the animal gets those components required for the building and maintenance of the body. A one-sided feeding with a superabundance of one certain foodstuff is always detrimental, but the grass diet in the summer season is, as a rule, satisfactory. The most important components of the food are albumen, fat, carbo-hydrates, and salts.

Proteid (white of egg) and fat are generally known; "carbo-hydrates" are farinaceous and sugary compounds. The cattle food must contain these components in certain proportions. A surplus of one component does not balance the shortage of another. Practice has shown that the cows require 1 part proteid to 4 to 6 parts carbo-hydrates plus fat. This is called the "proteid ratio," and the proportion should be = 1 : 4 to 6. If the proportion is 1 : 3 then it is called "too narrow." A proportion of 1 : 7, on the other hand, is called "too wide."

Most foodstuffs have been analysed, and the proteid ratios are known. On mixing various quantities of foodstuffs the calculation becomes more intricate, but remains feasible. The proteid ratio for a milk cow ought to be about 1 : 5½.

How can this be obtained? Suppose that a cow weighs 8 cwts., then the daily ration should be 17 to 21 lbs. "dry matter." This means that the ration should weigh 17 to 21 lbs. after evaporating all the water the food contains. Lists have been made showing how much "dry matter" and how much water the foodstuffs contain.

The composition of the ration should be such that it contains 17 to 21 lbs. dry matter, and in that dry matter the proteid ratio should be about 1 : 5½.

With tables showing the required ration in proportion to the living weight and tables showing the composition of foodstuffs it is an easy matter to calculate the winter rations for cows. Analyses of different foodstuffs are published in the *Agricultural Journal* by the Division of Chemistry of the Agricultural Department.

Salts form an important component of the food; they are indispensable for proper bone formation. As a rule the rations contain sufficient salts, but it may happen that the ration is deficient

in *lime*. In such cases the cattle should have access to a mixture of salt and lime or be served with drinking water rich in lime.

The process of "stripping" is important for obtaining a large quantity of milk.

In Denmark the milking process has been studied with particular care, and there it was discovered that the prevailing method still left too much milk and too much fat in the udder of the cow.

The best known of the newer milking methods is one conceived by the veterinary surgeon Dr. Hegelund, a system that is gradually spreading over the world. In places where *good* milking was in vogue (e.g. Holland) the improvement brought by the Hegelund system was small. But in many countries, more especially the Transvaal, the Hegelund method, well applied, will bring important gain. I quote his description here:—

The front teats are milked first, in such a manner that the right hand takes the left and the left hand the right teat. Milking is done with the *whole* hand. You begin by pressing the hands alternately against the udder. In raising the hand it is opened so far that the teat is only just touched, then a handful of milk is gripped and the hand lowered till the teat is pulled out to its *natural* length.

In bringing the hand downward, the teat is pressed in a downward direction with increasing pressure, which causes a regular flow of milk

Milk slowly in the beginning, taking care that the teat is not stretched, otherwise the cow will withhold the milk.

Milking should be continued quickly till it is finished. Pauses during milking are very wrong.

After the milking of the front teats the hind teats are treated in a similar manner.

Stripping.

Grasp the front teats again: the hands are pressed firmly against the under part of the udder, taking hold of it on one side with the thumb, on the other with the other fingers. By means of a light pressure the milk is forced into the cisterns and further through the teats.

When the front glands are emptied the hind glands are treated in the same way. The real stripping that now follows consists of three manipulations.

First Manipulation.—The right teats are pressed together by placing the left hand behind the hind teats and the right hand before the front teats, the thumbs on the outside of the udder, and the eight other fingers in the division between both halves. The hands are now pressed towards each other, and at the same time upwards towards the body.

This pressing and lifting is repeated three times, and each time the hands must glide down to strip the milk collected. When no more milk can be obtained, the left teats are treated in the same way. (See Plate 77, Figs. 1 and 2.)

Second Manipulation.—The teats are pressed together from the sides. The front teats are milked separately by placing one hand with the fingers spread on the outside of the teat and the other in the

Method of Stripping Cows.

Plate 77.

division between right and left front teats; the hands are pressed towards each other, and the teat stripped. Then the hind teats are milked by placing a hand on the outside of each teat with the fingers spread and pointing upwards, but the thumb before the hind teat.

The hands are lifted, and you grasp into the teat from behind and from aside, after which the hands are brought down to strip the milk. This is repeated till no more milk can be collected. (See Figs. 3 and 4.)

Third Manipulation.—The front teats are grasped with partially closed hands and lifted with a jerk against the body of the cow, both at once, by which treatment the milk glands are pressed between the hands and the body. The milk is drawn after every three jerks.

After the front teats the back teats are treated in a similar manner. (See Fig. 5.)

On hearing this description, stripping seems intricate and troublesome, yet it is really simple. By following the description carefully it can be learned quickly, and after some practice the whole of the stripping does not take more than three minutes.

The success of Dr. Hegelund's method is based on the fact that *the milk production is stimulated by the irritation of the milk glands.*

In the ordinary milking more milk than originally present in the udders is obtained, because the irritation of the udders causes milk production. This must be all the more the case if the method be applied which consists really of a continuous massage of the udder. As an instance of milk increase, Dr. Hegelund cites the following case. A heifer yielded 12 to 13 lbs. of milk daily. She was milked *seven times* daily during three weeks, and the milk yield rose to fully 31 lbs. This milk yield remained when milking three times a day was gradually resumed.

Straining of Milk.

Even the best precautions do not enable you to prevent dirt from entering the milk during drawing. This in itself is unpalatable, and this dirt harbours a great danger. All dirt is covered with *germs* (minute plantlets), and these germs cause the decay of milk.

If you could obtain milk absolutely free from germs, such milk would not decay. It is therefore important that dirt and germs should be eliminated from milk as soon as possible, and for this you can use the

Cottonwool Milk Filter.

In this filter some cottonwool is fixed which retains nearly all the dirt in the milk. After use the filter is taken to pieces, rinsed in cold water, cleaned in hot soda water, and rinsed in cold water again. *The cottonwool is destroyed after use.* No cottonwool is used twice. If you strain all milk at once after drawing, decay has not yet set in, and the milk will keep fresh for a longer time.

Cleanliness.

The foregoing shows that you may establish, as a rule without exception: *Dirt in milk means decay in milk.* Care should be taken to ensure the utmost cleanliness inside and out for everything that comes into contact with milk. All implements after use are

rinsed in cold water, then scrubbed in *hot* soda water, and, if possible, "steamed" or treated with boiling water. Thus decay in milk is obviated. But more precautions are required. Not only dirt, but *heat*, is an active principle in the decay of milk, as heat fosters the development of germs.

Aerating and Cooling.

This can best be done by means of a cooler of the counter-stream principle. At the bottom of the cylinder the water enters the spiral and runs from there to the top. Over the outside of the cylinder runs the milk. The warmest milk meets the warmest water and the coldest milk the coldest water.

In a few seconds the milk is refrigerated till a few degrees over the temperature of the cooling water. As the milk flows in a thin layer over the corrugated cylinder a good aeration takes place, which deprives the milk of noxious vapours.

This is the best way, but if it cannot be adopted you can place the cans in cold water and stir the milk. The cans must not be closed then, but covered with a strip of muslin to exclude dirt and insects.

I found the best temperature for refrigeration to be 38° to 40° F for a creamery and, perhaps, 46° to 50° F. for a farm dairy. These temperatures are not so easy to reach, and, therefore, you may make the rule: "Refrigerate the milk as much as possible."

The Calf.

It is a bad, unhygienic principle to allow the calf to suck. It is said you must allow this for Afrikander cattle, which will otherwise hold back the milk. For crosses and imported cattle, however, the sucking of the calf is not only unnecessary, but even wrong.

At once after the birth the calf should be taken away, and it should get no opportunity to suck; you can either teach the animal at once to drink from a pail or bucket, or use a "calf feeder" for some time. The breeding of calves without sucking has been adopted successfully in those countries from whence cattle are drawn for importation here. And if you look at the imported cattle you will have to concede that it is possible to rear a sound animal without sucking.

From a prize essay on cattle treatment I quote for the feeding of the newly-born calf the following prescription:—

"You give during the first twenty-four hours ¾ to 1 litre beestings.*

2nd day, 1½ litre beestings.
3rd day, 2½ ,,
4th day, 3 ,,
5th day, 3½ ,,
6th day, 4 ,,

"The milk ration is then increased every day with ½ to ¾ litre till 6 litres daily has been reached. Next you give the calf about 1/7 to 1/8 of its own weight in milk per diem. The first beestings should be given as soon as possible after birth. The number of feeding times per day is fixed for the first at four, the next three weeks three, and then twice daily.

* "Beestings" is the milk drawn during the first few days after calving.

"For long fasting and large quantities of food at once the stomach of the young animal is not arranged. It is better if you can continue to feed thrice daily for somewhat longer. The milk should always be as fresh as possible, and of the temperature of "body heat." For at least two weeks the food of the calf should consist of full milk; if you wish to breed strong calves this should be continued for four weeks, but you must never give so much that the calves fatten."

The breeding of good cattle can therefore be combined with obtaining much and good milk for butter and cheese making. The by-products of butter and cheese making, like skim-milk, whey, and buttermilk, can be used as food for the calves, provided these by-products are treated rationally.

The subject is by no means exhausted in these few pages, but I trust that this paper, read together with the leaflet "Milk Treatment," will give some idea of the main points. Perhaps I shall find the opportunity of referring again to some of the details.

II.—THE TRANSPORT OF MILK OVER DISTANCES.

By R. Pape, Superintendent of Dairying.

Frequently I have been asked "What is the utmost limit for milk transport?" As my reply must vary with circumstances, whether the milk is intended for consumption, for butter or cheese making, confusion may arise as to the possibilities of milk transport.

A distinction must be made between

(1) milk for consumption:
(2) milk or cream for butter-making:
(3) milk for cheese-making.

The requirements for these three varieties of milk are different, and it may occur that milk is fit for consumption but unfit for cheese-making, and vice versa.

In general the requirements for the three varieties are similar, but lengthy transit causes changes which influence the fitness of milk for various purposes. It makes a material difference whether the milk is drawn in the vicinity of a creamery which is reached after a short transit or whether the milk is to be transported over a long distance before the creamery is reached.

If the milk is well strained at the creamery, perhaps pasteurised and cooled sharply, it may be despatched a long distance, and yet arrive in a satisfactory condition for consumption provided it travels in a refrigerated van. Before the creamery is reached, however, every half-mile counts.

The freshly drawn milk is at a high temperature, which favours a fairly rapid decay. Therefore if the farmer wants to send uncooled milk to the creamery he can only send it a short distance. But if he buys a milk-cooler and has sufficient cold water at his disposal, then a rapid cooling after milking, and the accompanying aeration of the milk, will bring it into such condition that it can be transported over a much greater distance and yet reach the creamery in good condition.

An important factor in milk transit is, further, the state of the roads and the vehicle used. Only wagons provided with good springs should be used for transport of milk. Continuous shocks have the effect of churning the milk, and if, on a hot day, milk is transported for a long time on a wagon with bad springs, it may occur that the cans no longer contain milk, but buttermilk and butter. A shorter transit will perhaps form no butter, but then the milk has suffered so much that it yields considerably less butter.

Very instructive are the experiments of Fjord, which he continued during six days. One hundred and fifty kilograms of milk were divided into three portions of 50 kilograms each.

Fifty kilograms were placed in snow as soon as the milk reached the creamery. The butter obtained from this portion was taken as 100.

Fifty kilograms were kept waiting in the creamery uncooled during two hours, and were then placed in snow. The butter yield was 93.2.

Fifty kilograms were driven round on a springless cart during two hours and then placed in snow. The butter yield was 88.6. A simple lapse of extra time before the cooling of the milk caused a loss in butter of 6.8 per cent., and a two hours' drive on a springless cart a loss in butter of 11.4 per cent.

For butter-making it is, therefore, important that the transport be as short as possible.

When cream is gathered, the distance for transport can be increased materially, for butter can still be made from such cream though it reaches the creamery in fairly sour condition. But the butter from such cream will not be of such good quality as butter from cream raised in the vicinity of the creamery.

For cheese making the requirements are stricter; once the milk contains a certain amount of acid it is no longer possible to make first-class cheese. Considering the interests of the products only, the circle round the creamery should be of small diameter. If, however, the question becomes at what distance members may join, making the quality of produce of secondary importance in order to enable a great many farmers to join, then it is difficult to fix a limit. But it should not be forgotten that with the increase of transport distance the quality of produce must decrease.

For this reason the creamery should sort the milk very sharply, and treat milk from a long distance and milk from the vicinity quite separately.

All members of co-operative creameries should be obliged to buy a milk-cooler, which would improve the quality of the milk received at the creamery.

I want to point out that the financial interest of members in the vicinity of the creamery tends to make the circle of suppliers not wider than is absolutely necessary to obtain the required quantity of milk. Milk from members in the vicinity of the creamery will yield the best quality of produce, whereas the milk from a distance will yield produce of inferior quality. The creamery pays all members the same price, and this is fair. But with the increase of long-distance milk, the average quality of the produce decreases, and with this the net result.

Up to a certain limit this is more than counterbalanced by a decrease in working cost with increasing quantities. That limit is the full capacity of the creamery; when this is reached the increase of long-distance milk will cause no profit. Therefore the aim should be to gather all the milk required for the creamery in the smallest possible circle.

In calculating the distance for milk transport a difference should be made between rail transport and cart transport. By rail the milk can be sent considerably further than by cart, because rail transport is quicker and the milk is less subject to harmful influences, always supposing the necessary precautions are taken.

Milk should not stay at the station waiting for a train longer than absolutely necessary, and if it has to wait then it should be kept in a cool, shady place, and not in the sun. The railway vans should be fresh and well ventilated. Open trucks are not fit, because they expose the milk to the sun.

In Circular No. 4 of the Dairy Division five rules are given for milk transport over long distances. I will try to explain them here.

1. Use square milk-cans. This is for rail transport of several cans at once from one or more stations. The square cans fit more closely than the round cans, and the milk will increase less in temperature.

2. Wrap a towel or sack round each can, the wrapping to be kept continually damp. For the evaporation of moisture from the wrapping, heat is required; this heat will be derived partly from the milk, which keeps the milk cooler.

3. Make the conveyance as dark as possible, providing ventilation. By making the conveyance dark it is at the same time kept cool. Ventilation has a similar tendency.

4. Paint the outside of the wagon white. This, too, is a means to keep it cool. A dark surface will absorb heat, but a white surface will reflect heat.

5. Place the milk in a cool dark place immediately on arrival. This increases the keeping qualities of the milk.

Reviewing the preceding concisely, the following rules may be deduced:—

1. Milk should be drawn as cleanly as possible and strained and cooled at once.

2. The transport must be quick, taking care to keep the milk cool and dark, and protecting it against shocks and jolts.

III.—A PRACTICAL MILK SIEVE.

By R. Pape, Superintendent of Dairying.

Many designs have been made for a milk sieve that satisfies practical requirements. I have evolved one for use in creameries, where the sieve must not only work satisfactorily but at the same time rapidly.

The construction I designed gave good results in practice, but it seems to have escaped more general notice. Since then different instruments have been patented, but they seem to me rather intricate, however well they may work. Therefore I will describe a simple

instrument I caused to be constructed some five or six years ago, and which, when treated properly, will give very good results.

The old milk sieves all have the drawback that the openings are in the sieve bottom. The dirt is retained by the sieve bottom, but is always under pressure of the layer of milk above it. As a consequence the dirt will gradually be forced through the sieve bottom, or the sieve will get clogged with dirt. In my sieve this drawback has been evaded.

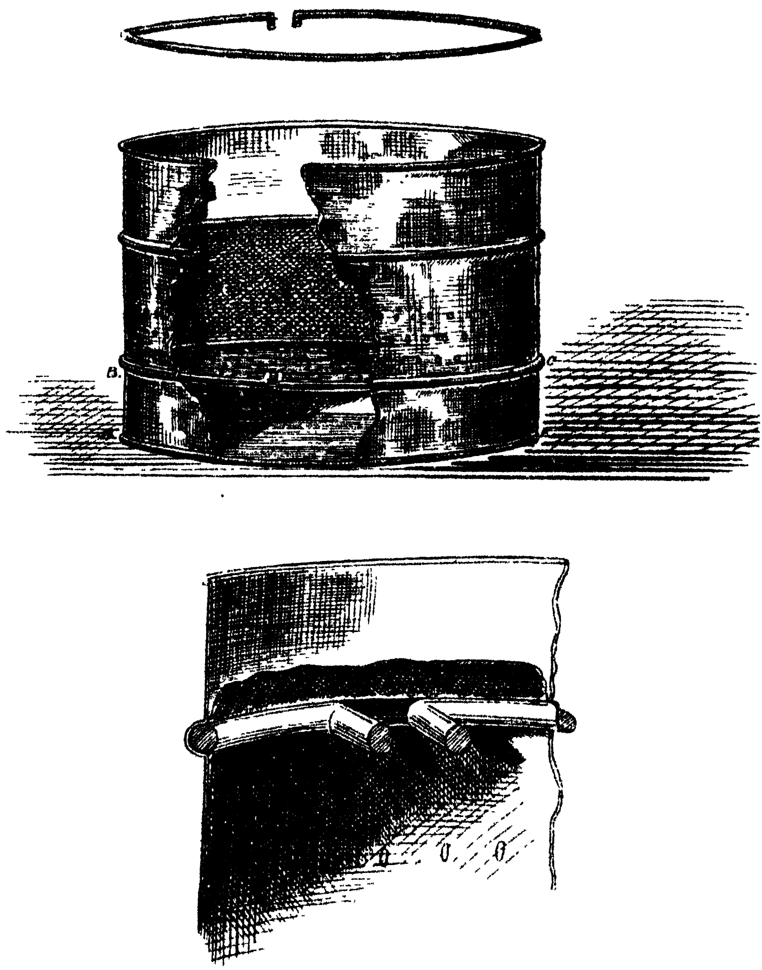


Plate 78

A Practical Milk-sieve.

A is a perforated false bottom. The true bottom of the sieve is not perforated, and the side walls only partly. Over the perforated wall a fine straining cloth is stretched that is kept in position by catch rings. When the sieve is taken into use and filled with milk, the milk will escape through the side walls, and the dirt will gradually silt down till it reaches the "dirt catcher" (Plate 78) B D E C.

When more milk is poured into the sieve all the dirt would be stirred up again but for the false bottom, which prevents the dirt, once in the dirt catcher, from reaching the sieve cloth again. By making the sieve not higher than 6 to 10 inches you can prevent the pressure ever being great enough to force dirt through the sieve cloth.

When in use the sieve is standing in a tank that receives the escaping milk. If required, hooks can be fixed to the sieve enabling it to be hung up over the tank. When straining is finished the milk which is left in the dirt catcher is brought on to the straining cloth by tilting the instrument. It is better to keep this milk separate: it is of a less good quality, as it has continuously remained in contact with the dirt.

As the picture shows, the side wall is indented in two places, so as to form hollow rings in which the catch rings are fixed.

Within certain limits this sieve can be constructed in all desired dimensions. The only difficulty met with in the larger sieves is in the construction of the catch rings. The largest sieve of this pattern I had made had a diameter of about 4 feet and a total height of 10 inches. The effect could be judged when the sieve was cleaned and shovelfuls of dirt came from the dirt catcher.

The construction is not very intricate, and any smart coppersmith should be able to make it. Special attention must be given to the catch rings; they must be very elastic, and keep the straining cloth firmly in position against the sieve wall.

IV.—CREAM CHEESE.

By R. Pape, Superintendent of Dairying.

The name "cream cheese" is used for various products sold in different shapes and made in different ways. The recipes for making cream cheese vary very much accordingly. Here follow a few:—

Sour cream is hung up in a linen bag to drain off the whey. This gives a fairly firm product, which is pressed in moulds. Though it produces a palatable article, it is not fit for the trade, as the product does not keep long enough.

In France full milk is curdled by means of rennet, and left to drain. Then the curds are put into moulds in fine linen and left to drain for a further two hours. After this it is promptly sold. The curd is eaten with cream.

Other varieties are prepared in a similar manner, though with this difference, that curd and cream are well mixed, pressed in moulds, and sold in different shapes and under different names. These modes of manufacture are less important to the Transvaal, as such "cream cheese" keeps for a very short time only, and should be sold and consumed very soon after production. Transit over long distances is not very feasible.

But from cream a variety of cheese can be made which keeps for a longer period. The following is the recipe:—The cream is put into the cheese kettle, as *fresh as possible*, at a fairly low temperature, say

27° to 28° C. (80° to 82° F.). Now so much rennet powder or rennet extract is added to make the cream take a few hours to "thicken," say two to five hours.

I cannot mention an exact quantity of rennet, as rennet powders and rennet extracts vary so considerably in strength. An experiment will soon show how much rennet is required. By means of fairly intricate formulæ it is possible to calculate the quantity of rennet required once the strength is known, but an experiment is much simpler than the calculation. After adding the rennet the cream is well stirred for a few minutes, covered with a gauze, and left.

When the cream is "thick" enough it is ladled into moulds in which fine cheesecloth (linen) has been put. The cheese is pressed now to obtain the required firmness, and then the outside is strewn over with pure, fine salt. Then the cheese is left for some time in a fairly moist, dark locality to give the salt the opportunity to penetrate into the cheese.

In this country an "imitation" cream cheese is sometimes made by mixing full milk with the cream. I have even seen cases where so much milk was used that it really came to adding a little cream to the milk. This way of making is, naturally, cheaper than the use of pure cream, but the result is a lower-grade product, which cannot compete with the real cream cheese.

In closing, a warning! Cream cheese is not a product for oversea export, and the South African market for this article is very limited. For a few people it may be a remunerative business, but if many farmers start making cream cheese the market will soon be glutted, and the price will go down in consequence.

The Sheep-farming Section.

I.—THE CULLING OF MERINO SHEEP.

By Vincent Bossley, Flockmaster and Wool Expert.

In my last article* the main principles of classing wool were dealt with from the point of view of the wool classed. I now propose to give a few hints which may in a general way guide the sheep-breeder in his efforts to place good wool before the classer who, under no circumstances, can be expected to improve bad wool in itself, though he may do much to place an inferior clip before the buyers, in an attractive manner.

The most important, interesting, and effective task of the sheep-breeder or flockmaster must always be the careful systematic culling out from his sheep year by year of all the inferior animals he can afford to discard.

The term culling is sometimes erroneously confused with the term sheep-classing. To class sheep is to arrange them in numbers or separate flocks according to their quality. To cull is to throw the worst sheep out altogether from the flock.

The most valuable flocks of other countries have been built up to their present high standard of excellence by continuous and judicious culling, while here in the Transvaal it has been the general custom to breed indiscriminately from any ewe or ram unless it happened to be too old to breed or likely soon to become too old to sell. This is perhaps one of the main reasons why the flocks of the Transvaal do not compare better with those of Australia and Tasmania.

It is plain that the man who does not cull must be on a long trail in regard to the improvement of his sheep. For every good lamb he obtains from his good ewe he will also obtain a bad one from his inferior ewe. Also it has been found in practical experience that a poor class of ewe carrying little wool is, as a rule, the more prolific in breeding and rearing lambs.

At least once a year all the breeding animals in a flock should be carefully overhauled one by one, and a plain distinctive cull mark put on the worst animals, so that they can be got rid of as opportunity offers.

It is essential that the owner or flockmaster when carrying out this task notes the general type of the sheep he is working amongst, and culls with the distinct idea of preserving the largest possible number that show the best characteristics of their particular variety or breed. The sheep in ordinary flocks cannot be expected to be perfect, but they should have as few faults and be as evenly balanced in body and wool as circumstances will permit. One of the worst defects which merino sheep are subject to is the malformation known as the devil's grip. This appears in the form of an indent or dip just behind the wither, continued down on each side of the sheep behind the shoulder, and gives the animal a constricted appearance, much the same as if a string had been placed round the body and tightened. The devil's grip is readily and consistently transmitted from one generation

* Vol. VII, No. 25, p. 15, October, 1908.

to another, often giving young sheep a crippled, deformed look. Such sheep, besides being unshapely, are delicate and bad thrivers.

Other bad points to be remembered when culling are: a thin neck, narrow back, flat sides, bad eyes, undershot or overshot mouth, narrow front and brisket, narrow between hind legs, weak quarters, and small bones.

With regard to covering or wool, the following may be considered some of the very worst points:—A thin pointed tip, open staple, too short, too fine, and weak in staple, too much variety in the wool, thin and open behind arm and near flank, light and scanty on belly, and when the wool feels harsh, rough, and unnatural.

The individual shearing return is considered by some to be the true test of the sheep, and so far as the wool value is concerned the shearing floor is the final court of appeal. But there are many other points to be considered besides the present wool return from a flock. The future must not be lost sight of, as it spells only failure if a flock, though giving a big wool return, is losing in constitution and prolificness. Many a good lot of ewes in Australia has been utterly ruined by culling solely on the wool valuation and fleece without taking frame and constitution into due consideration.

Again, the amount of wool on a sheep is not of such importance as quality, because so long as quality is retained the path to improvement is plain. But once let a rough, coarse strain of wool be bred into a pure merino flock and years will be taken up in eradicating it again. This also has been proved in Australia, where some years ago a craze for the introduction of Vermonts seized hold of prominent breeders. Without waiting to distinguish good from bad, many hairy, coarse-woolled rams were used, simply because they could claim Vermont as their native land, or were said to be of American descent. The result is to be seen to-day in flocks, the main characteristics of which in days gone by were fineness, quality, and even fleeces, but which now shear several different wools, and show coarseness and hairiness to a marked degree. This in spite of every endeavour to breed away from it, as proved by the denial of owners that Vermonts were ever used in flocks where coarse-grade Vermonts were seen but a few years back

Much of course depends on the material already in a flock, but in any case vast improvement can and has been attained by careful culling based on a certain aim or ideal which the breeder follows up by all the means in his power.

By paying strict attention to culling, many a small owner in Australia, from practically nothing, and has at little monetary cost reached fame and who could not afford to purchase expensive rams, has built his flock up wealth.

II. STUD STOCK.

By "Camden" (*Pastoralist's Review*, 15th February, 1908).

After all, the success of stud breeding depends upon the man who actually mates the stock, whether he be the owner or the manager. It must be one or the other. Rarely can two or more men successfully control a stud, because the whole secret is—one ideal, and stick to it. There may be, say, three men, each capable of breeding high-class

sheep if left to himself, but if they combined together they probably would achieve nothing, because, perhaps unconsciously, each would be following out his own ideal, and there would be a conflict of purpose. This individuality of ideas is a pronounced feature of breeding.

Take an instance near at hand. Many of the leading merino studs in Tasmania are practically of the same blood, yet each breeder's sheep are noted for peculiar characteristics. Bellevue sheep have an individuality of their own, so have Winton, Barton, Bengeo, Rhodes, and Scone, simply because the breeder in each case is working out his own idea.

It can thus easily be seen how essential it is that the man who takes a stud in hand should remain permanently at the head of affairs; in other words, owners who do not take an active part in the management of the studs should stick to the men who have brought their flocks or herds into prominence, or when choosing a man they should see that he possesses every qualification for permanently filling the position.

Breeding is a slow process, and the great essential—fixity of type or character—can only be got by years of work, and if the stud has reached a certain point, and it is handed over to a new man, the chances are all against the new-comer keeping up the standard attained by the other man, simply because the ideals of the two men differ. For a few years after this change of management, despite careful culling and mating, the stud will lose the individuality it has attained, and there will be a decadence in character, because the mixing of the ideals and methods of two men is almost akin to a crossing of types. Years, again, have to pass before a new order of things arises as a result of the ideas of the new-comer, and possibly the purchase of a different strain of sires has added further complications.

The whole aim of breeding is to develop the best characteristics of a breed and to make those characteristics hereditary. This can only be done by years of careful culling and mating for one ideal. Frequent changes of strains or types, and changes of management, work dead against studs attaining any great prepotency. It is not an uncommon thing to see wealthy men buy the best rams procurable and use them in high-priced flocks, yet they have never established a really fixed type, nor even have they obtained any real first-class progeny. The sire, no doubt, was worthy of its reputation and the figures paid, but the question whether it was not too violent a departure from his own type of sheep was either misjudged or ignored by the purchaser. The same thing may be repeated year after year, especially if there is a frequent change in the management of the stud.

One commonly hears the question asked, "What becomes of all the great rams that have changed hands? One rarely hears of either them or their progeny." No doubt the answer largely lies in the fact that many have been purchased by men who are always chopping about either with several types of rams or they have unstable management, consequently their progeny are rarely ever heard of.

Glancing over the array of the leading merino flocks of Australia, in nearly every case the present studmaster has had sole control since the foundation of the stud. They commenced with a fixed purpose, and by culling and selection they have got sheep that throw true to

type. The Vermont sheep, carefully bred for a great number of years, is very prepotent, and of the Australian types the Wanganella, Boonooke, and South Australian sheep put an unmistakable stamp on their progeny. A capable man, given good sheep of an old prepotent strain, can improve by selection if left to work in his own way.

By chopping about with different types one might now and again breed a creditable sheep, but most likely it would not get stock as good as itself; and almost as unsatisfactory is the keeping to one strain of sheep but chopping about with managers. The change of management with stud breeding should be avoided whenever possible. Even if the incoming man is better than his predecessor, it means years before he can establish his better ideals.

The process is tedious enough with sheep, but it is far more so in regard to cattle and horses.

III. POINTS OF STANDARD AUSTRALIAN MERINO SHEEP.

THE following information has been kindly furnished by Mr. Robert Farrell, of Johannesburg:—

DESCRIPTION OF POINTS AND THEIR VALUES OF MEDIUM COMBING RAMS.

(By Alexander Bruce, Chief Inspector of Stock, New South Wales.)

	Single Points. 250 Agg.	Groups. Agg. 100.	Divisions. Agg. 100.
I.—BREEDING AND QUALITY.			
I.—Pedigree and Offspring.			
1. "Pedigree"—According to standing in Stud Book or as proved by certificates and declarations.	20	16	
2. "Offspring"—To be viewed from the character of the offspring as shown by their success at shows ...	20		
II.—General Appearance, Style, and Character.			
3. Symmetrical Form, and proper Complexion and Covering	10	4	28
III.—Head.			
4. "Countenance"—The forehead should be broad, and the countenance healthful	5	8	
5. "The Eyes" should be bright or placid, and free from spots	3		
6. "The Muzzle," etc.—The muzzle should be clean, the nostril expanded, and the nose white, wrinkly, and covered with short, furry, soft, velvety hair	5		
7. "The Ears" should be white, soft, thick, wide apart, and partly covered with wool	3		
8. "The Horns" should be not too close to the head and neck, nor standing out too widely, and free from black or dark streaks	4		

	Single Points. 250 Agg.	Groups. Agg. 100	Divisions. Agg. 100.
II.—FORM AND CONSTITUTION.			
IV.—Fore Quarter.			
9. "The Neck" should be short on the top, deep when viewed from the side, and long below, strongly set to the head and shoulders towards which it should be becoming deeper...	5		
10. "The Shoulders" should be broad and massive as to depth and breadth, very little, if any, above the level of the back, and well placed	4	6	
11. "The Chest" should be wide and deep	4		
12. "The Skin" should be thick, soft, and pink	2		
V.—Middle.			
13. "The Barrel" should be round and lengthy	6		
14. "The Back" should be short, level, strong, and straight	5	6	
15. "The Loin" should be broad and strong	4		
VI.—Hind Quarter.			
16. "The Flank" should be deep and straight	4		20
17. "The Quarters" should be long and well filled up ...	4	4	
18. "The Thighs" should be long and broad	2		
VII.—Legs, Feet, etc.			
19. "The Legs" The forelegs should be short, straight, and well apart, and the hind legs should be set so as to give the hind parts a perpendicular appearance, while the bone should be heavy, but of fine texture	5		
20. "The Muscle" should be fine and firm	2	4	
21. "The Hoofs" should be clear in colour and well shaped	3		
VIII.—Size.			
22. "Size"—According to the class of sheep	5	2	2
III.—THE WOOL.			
IX.—Quantity.			
23. "Length of Staple"—According to division	5		
24. "Density"—Closeness and thickness all over, but especially on the top of the shoulder and back ...	30	22	22
25. "Evenness"—In length and density of fleece over the whole body, legs, belly, back, and head	20		
X.—Quality.			
26. "Brightness, including Lustre," denotes facility for taking delicate dyes	5		
27. "Softness"—Soft and silky to the touch, but elastic	8	8	
28. "Crimp"—The regularity of the waves, and trueness of the fibre	7		
29. "Freedom from Gari," i.e. "Kemp"	5		
30. "Fineness" According to division	17		
31. "Freeness"—Denoting few noils in combing, and including building up of staple	6	18	28
32. "Evenness"—In the quality of the fleece, over the whole body, legs, belly, back, and head	17		
XI.—Condition.			
33. "Quality of Yolk"	3	2	
34. "Fluidity of Yolk"	2		
Aggregate numbers	250	100	100

ABSTRACT.

	Single Points.	Groups.	Divisions.
Breed and quality ...	70	28	28
Form and constitution...	54	22	22
Wool	126	50	50
TOTAL MARKS ...	250	100	100

* * * *

The points and values for ewes are the same as for rams, with the following exceptions:—The marks for "muzzle" are, for ewes, four instead of five; those for "horns" are omitted, and five marks added for "evenness of covering." Scales of points and award papers are only given for medium combing sheep.

By reducing the points of "size" and "length of staple," and increasing those for "softness" and "fineness," the scale here given for "medium" will suit for fine-woolled sheep; and by increasing those for "length of staple" and "brightness," and reducing those for "softness" and "fineness," the scale fixed for "medium" will answer for "strong."—Robert Farrell.

* * * *

AWARD PAPER FOR STUD SHEEP—MAXIMUM POINTS: 100.

(Sheep and Wool Department, Technical College, Sydney.)

Constitution, 60.		Wool and Covering. 40.					Maximum.
Constitution.	Symmetry Form.	Robustness.	Fineness.	Evenness of Covering.	Density.	Quality.	100.
1							
2							
3							
4							
5							
6							

Official Score Card of the Standard American Merino Sheep Breeders' Association.

	Constitution—Fifteen Points.	
1.	Bone	5
2.	Physical development and general appearance ...	10
	Form—Forty Points.	
3.	A broad head, wrinkly nose, and face covered with a soft, velvety coat	5
4.	Short, broad, muscular neck, well set on shoulder ...	5
5.	Massiveness of shoulder as to depth and breadth ...	5
6.	Level, straight back and rotundity of rib	5
7.	Breadth and length of hips	5
8.	Straight forelegs, well set apart	3
9.	Straight hind legs, and set so as to give a perpendicular appearance to the hind parts	5
10.	Soft, thick, velvety ear	2
11.	Pure white nose, ears, and hoofs	5
	Wrinkles—Fifteen Points.	
12.	Heavy, pendulous neck	5
13.	Across arm and point of shoulder on side, and running well under	5
14.	Tail, hip, folds, and flank	5
	Density of Fleece—Fifteen Points.	
15.	On neck	3
16.	On back	3
17.	On side	3
18.	On hip, and extending to flank	3
19.	On belly	3
	Covering—Fifteen Points.	
20.	Crown of head or cap	3
21.	Cheek	2
22.	Foreleg	2
23.	Armpit	2
24.	Hind leg	2
25.	Inside of flank	3
26.	Connection betweeen tag wool and belly	1
		100

Fibre to be indicated as "fine," "medium," and "strong." Oil as "buff" and "white."

The Entomological Section.

I. THE ROOT LOUSE OF GRAPE VINES.

(*Phylloxera vastatrix*, Planchon.)

BY DAVID GUNN, Acting Government Entomologist.

AMONGST the numerous insect pests prevalent in the Transvaal the recently discovered phylloxera must be considered as one of the most dangerous. On account of the enormous amount of damage which it has caused to grape vines in North America, Europe, and Cape Colony, its introduction into the Transvaal should be treated with serious consideration, and prompt and drastic measures adopted to prevent its dissemination, in order that our developing grape vine industry may be saved from destruction. Of nearly 280 insects which have been listed as causing damage to grape vines throughout the world, phylloxera must be considered as the one of greatest economic importance, and hundreds of memoirs have been published regarding it.

HISTORICAL.

The phylloxera is a native of the United States of America, east of the Rocky Mountains, where it is still found living upon wild vines. From America it was introduced into Europe about 1860, and subsequent to that period it has caused an enormous amount of devastation, especially in the southern parts of Europe. Its presence was discovered in the Transvaal about five months ago in a vineyard belonging to Mr. Samuel Marks, Zwartkoppies, Pretoria District, and so far as can be ascertained it was introduced from France on vines purchased some years back.

LIFE HISTORY OF THE INSECT.

The following life history of the phylloxera has been compiled from a work on this subject by Mr. Quayle, entitled "Insects injurious to the Vine in California."

Victor Mayet, who worked out the life history of this insect, describes four distinct forms in the following order:—

1. The gall insect or form of multiplication.
2. The root insect or form of devastation.
3. The winged insect or form of colonisation.
4. The sexual insect or form of regeneration.

The gall insect lives upon the leaves, and is the most common form on the wild vines in the native habitat of the insect. In Europe it is often found upon American and rarely upon European varieties. It causes little swellings or galls upon the leaves and younger parts of the vines, which, though sometimes very numerous, do little permanent injury. The chief danger from the gall form is that it multiplies with astonishing rapidity and migrates from the leaves to the soil. It there attacks the roots and gives rise to the root form, which is the "form of devastation," the one which finally destroys all the vines it attacks which are "non-resistant." Every insect of the root form which reaches maturity lays about twenty-five or thirty eggs, each of which is capable of developing into a new

Plate 59.

Phylloxera vastatrix.

Galls formed on leaves of vines.

Plate 80 *Phylloxera vastatrix.*

(After Kirchner and Holtshauser Atlas der Krankheiten.)

Fig. 1 Roots of attacked vines

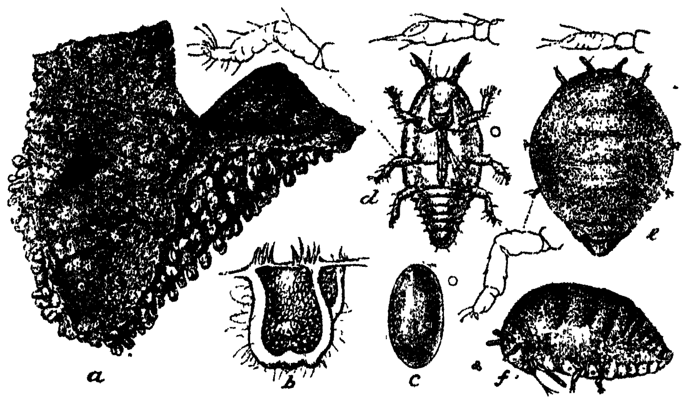
Fig. 2 Old roots of grape-vine, showing swellings caused by *Phylloxera.*

Fig. 3 - Leaf of vine with galls.

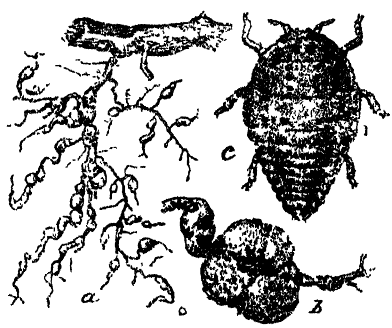
Fig. 4. Section through leaf-gall (enlarged).

egg-layer *needing no fertilization*. As there are from five to seven such generations during the year the increase in numbers is extremely rapid.

Life history of *Phylloxera vastatrix*.
(From *Farmers' Bulletin No. 70*, U.S.A. Department of Agriculture.)



Phylloxera vastatrix. *a*, leaf with galls; *b*, section of gall showing mother louse at centre with young clustered about; *c*, egg; *d*, larva; *e*, adult female; *f* same from side; *a* natural size, rest much enlarged (original).



Phylloxera vastatrix. *a*, root galls; *b*, enlargement of same showing disposition of lice; *c*, root-gall louse much enlarged (original).

Sometimes during the summer some of the eggs laid by the root insects may develop into insects of slightly different form called nymphs. These are somewhat larger than the normal root form, and show slight protuberances on the sides, which finally develop into wings. These are the winged or colonising insects, which emerge from the soil, and, though possessing very weak powers of flight, are capable of flying a short distance, and if a wind is blowing may be taken many rods, or even miles. Those which reach a vine crawl to the under-side of a leaf, and deposit from three to six eggs. These eggs are of two sizes, the smaller of which produce males and the larger females. The females arising from these eggs, after fertilization, migrate to the rough bark of the two-year-old wood, where each deposits a single egg, called the winter egg, which remains upon the vine until the following spring. The insect which hatches from this egg in the spring goes either to the young leaves and becomes a gall-maker, or descends to the roots and gives rise to a new generation of egg-laying root-feeders.

The normal and complete life cycle of the phylloxera appears then to be as follows:—*Male* and *female insects* (one generation in autumn); gall insects (one to five generations while the vines are in leaf); root insects (an unknown number of generations throughout the year); nymphs, which become *winged insects* (one generation in midsummer). For how many generations the root form can exist and reproduce, with invigoration supposed to come from the production of the sexual form, is not known, but certainly for four years and probably more.

All forms of the phylloxera are extremely minute, the root form being about one-twenty-fifth of an inch long when it reaches the adult egg-laying stage, and little more than half this length when young and active. It is just large enough to be seen by the unaided eye in a good light, when its presence is known, and by the help of a glass magnifying five diameters its legs and antennae are plainly visible. Its colour is light greenish-yellow in summer and somewhat darker in winter, so that when numerous the roots appear as though dusted in spots with powdered mustard or cinnamon. The newly-hatched insect is fairly active, and at first moves about from place to place on the roots, but, finally, when it reaches the egg-laying stage, it inserts its sucking tube into the root and remains

Injury caused to Vines.

Although a certain amount of nutriment is taken from the vines by the phylloxera, even when they are present in enormous numbers, such injury is not accountable for the disastrous effects upon the plants. The phylloxera inserts its sucking-tube into the vine, which produces a swelling, and decay soon afterwards sets in

It may be possible that during the first two years when the vines are attacked no apparent damage can be observed, as such may be equivalent to root pruning, which may materially assist in producing a large crop of grapes. This is especially the case when vines are planted on rich soil. In subsequent years, however, the injury becomes more apparent, and the vines, being unable to recuperate, generally die.

Methods by which the Phylloxera spreads.

Phylloxera may be disseminated in the following manner: When vines are at first attacked by the root form, the insects gradually but continuously spread through the soil to the neighbouring vines, and form what are known as "oil spots." The area of infestation is gradually enlarged year after year, until after a time, if no preventative measures are adopted, a whole vineyard becomes infested. The spread of this dangerous pest is, however, accelerated by the winged form, which materially assists in destroying a vineyard. and also by the insects in the root form being carried on ploughs or other agricultural implements which are used for the purpose of cultivating vineyards.

Measures for Combating Phylloxera.

Various measures have been adopted in Europe and in North America for the purpose of combating phylloxera, and amongst the most important of these are the following:—

1. Injecting carbon bisulphide into the soil.
2. Flooding of infested vineyards.
3. Planting vines in sandy soil.
4. Planting resistant vines.

Carbon bisulphide as a remedy against the depredations of the phylloxera has been extensively used in North America and Europe with varying success, but on account of the fact that it only has been proved to be successful in deep loose soils, which do not contain a large proportion of clay, the method has never been entirely successful.

Carbon bisulphide is a liquid which volatizes readily at ordinary temperatures; the gas is poisonous, is in confinement inflammable and explosive, and it is therefore necessary that the greatest precautions should be adopted that no light such as a lighted cigar, pipe, or match comes in contact with it.

In Europe and America it has been used for the prevention of the dissemination of the root form of the phylloxera at the rate of from 125 lbs. to 200 lbs. per acre at any time except during blossoming and ripening of the fruit. It has been found in these countries that two treatments are necessary, one directly after the vintage, and the other a week or so before blossoming. The great volatility of carbon bisulphide enables it to penetrate to the minutest roots of the vines, and the phylloxera is quickly destroyed. The method of applying this remedy is to pour from one-quarter to three-quarters of an ounce into holes made about 24 inches apart all over the vineyard. The holes should be made 15 inches deep, and immediately after the carbon bisulphide has been poured into these the ground should be firmly pressed over them with the foot. As this chemical costs approximately about 10s. per gallon delivered in the Transvaal, it will be readily perceived that this remedy cannot be recommended on account of the expenditure involved, which would make its use almost prohibitive.

The second method to be considered is the flooding of infested vineyards, but this treatment is of course only practicable in a few localities, more especially where an abundant supply of water can be obtained. In adopting this remedy, infested vineyards should be submerged with at least 6 inches of water, as the main object is to drown the phylloxera by depriving it of air. The greatest care should be taken that the surface does not become exposed even for a short period, as if such should occur the insects will undoubtedly obtain a fresh lease of life. Further, the flooding of infested vineyards can only be effectively undertaken during summer when the insects are in their most active condition, but, unfortunately, at that time the vines are most susceptible to injury. The best period for the submersion of infested vineyards is shortly after the vines have ceased their active growth, and before they have commenced their hibernating or dormant condition. The adoption of this remedy cannot be considered in the Transvaal on account of the unreliable rainfall, and also on account of the enormous expenditure in connection with the erection of large dams which would be required for the storage of the water.

The third method to be adopted is to plant vines in sandy soil, as it was early observed in both America and Europe that vines which were planted in such soil were more immune to the attacks of phylloxera than those planted in soil containing a large proportion of clay. This immunity is probably owing to the fact that sand does not crack, and thus prevents the dissemination of the insects, being more thoroughly wetted and liable to retain subterranean

moisture. In this manner the insects are liable to be drowned out as in submergence.

The fourth most effective remedy of preventing the dissemination of phylloxera is planting vines which are resistant to the attacks of this insect, and as this method is fully described in this *Journal* by the Government Horticulturist, it is unnecessary to further refer to it in this article.

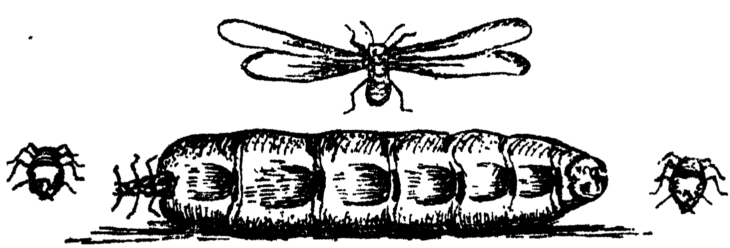
As the use of carbon bisulphide and submersion of vineyards is absolutely impracticable in the Transvaal, we have adopted the most effective, and certainly the most drastic remedy for the eradication of this pest, viz., the uprooting and destruction by fire of the infested vineyard in question, and before this article will have appeared in this issue of the *Journal* the infested vineyard at Zwartkoppies will no longer be in existence.

Immediately after the discovery of phylloxera in the Transvaal, we circularised all our nurserymen to the effect that a thorough examination of their nurseries would be made in order to find out whether the vines which are grown by them and sold to the public are upon their own roots, or not. It is most gratifying to have to report that immediately upon receipt of this circular a certain prominent nurseryman in the neighbourhood of Johannesburg promptly destroyed a few thousand vine stocks which were not upon roots resistant to the attacks of phylloxera. After this inspection, which will naturally occupy some considerable time, has been made, we expect to be in a position to definitely state whether phylloxera has made its appearance in other districts of the Transvaal. Although we do not at the present moment anticipate that such will be the case, nevertheless we intend to adopt very strict measures in order to prevent the further dissemination of this dangerous pest.

The various vine growers in the Transvaal are earnestly requested to immediately notify the Government Entomologist, Pretoria, as soon as they discover their vines to be suffering on account of insect pests.

II. NOTES ON TERMITES: No. III.

By F. Thomsen, Division of Entomology.



Termites, or as they are often wrongly called, "White ants," are among the most troublesome insects in South Africa. There is not a farmer or a resident in the warmer parts of the Transvaal who has not suffered at one time or another from the destructive attacks of these pests. How great these losses are is not known, as no statistics have as yet been compiled in this respect. It should, however, be stated that from what one often hears the damage must be quite considerable.

Anybody who has travelled in the bushveld knows how quickly these termites attack woodwork in a house or settle in the thatched roof of a cottage, building covered gangways by means of sand and clay taken from the walls or surrounding ground. Every particle of earth is glued on, somewhat as a bricklayer would use mortar; the substance which the termites use for the purpose is not known as yet, but it seems to be a sticky exudation, which makes quite a strong structure; as one finds if these covered gangways have to be removed from a wall or tree. Water is necessary for that purpose, for in winter, when everything is dry, these structures can easily be crumbled away; but during the rainy season they will be found very strong and solid when once dry. The termites have many enemies, and these gangways are built to allow a safe passage over exposed positions, and to protect against birds and other insects.

Quite a number of fruit and ornamental trees are checked in their growth or killed outright every year by the attacks of these insects. Some varieties of trees are more readily eaten than others. It is possible, however, that some species of termites prefer certain kinds of wood or vegetable matter, and only attack these when present. As the preservation of wood or trees is quite an important question to many people, this division decided to make extensive experiments, and although they are not yet completed, the following notes will throw some light on the subject.

In August, 1907, Mr. C. W. Howard, then Government Entomologist to this Department, wrote as follows concerning the preliminary stages of these investigations:—

"The tests were carried on in the following manner. About 800 pieces of wood were obtained of a uniform size, 3 in. × 3 in. × 12 in. These were mostly of deal, but some blue gum, boekenhout, and lemon wood (*Xymalos monospora*) were employed; all of which woods are readily eaten by white ants. In selecting the materials with which to treat the woods, we tried to test such substances as the farmer would have at hand or could easily obtain, also giving attention to patent mixtures, for sale on the South African market, which are recommended for this purpose.

"The methods for treating the wood were four in number: i.e. (1) soaking in the mixture for twenty-four hours; (2) soaking for twenty-four hours and then bringing to the boiling point over a fire and boiling for from one to two hours; (3) painting the surface with one or two coats of the mixtures; (4) boring a hole ½ in. in diameter down the middle, filling this with the liquid or dry chemicals and plugging up the opening, leaving the chemical to soak through the wood. A certain number of pieces of deal and blue gum were left untreated, to act as a check on the experiment.

"When the pieces of wood were all ready they were thoroughly mixed up, so that any two pieces which had been similarly treated should not be together, and were then planted in the soil about 12 feet apart each way, with the upper ends above the surface. Care was taken to choose a place to bury the wood where termites were very abundant. For this purpose Mr. E. F. Bourke, of Pretoria, kindly allowed us to make use of his farm Kalkheuvel, near Pienaar's River Station, District of Pretoria. Parts of this farm are badly infested with white ants, and the worst parts were employed for this experiment. The wood was buried on the 27th March and 15th April, 1906. The first examination was made on 4th June, 1907."

A year having passed since the above notes were written, a second examination was made on 21st August, 1908.

The following table will indicate materials employed, kind of wood used, and the results obtained. The materials have been grouped together under several headings for convenience:—

I.—ARSENICALS.

Wood Employed.	Chemical used.	Treatment	Result at first Examination. 4th June, 1907.	Result at second Examination, 21st August, 1908.
Deal ..	Arsenite of Soda. 10%	2 pieces soaked 24 hours	Not eaten ..	Not eaten.
Do. ..	Do.	2 pieces soaked 24 hours and boiled	Do	Do.
Do. ..	Do.	2 pieces, hole in centre filled	Slightly eaten	Eaten.
Lemon Wood	Do.	1 piece soaked 24 hours	Not eaten ..	Not eaten
Blue Gum..	Do.	2 pieces soaked 24 hours	Do	Do.
Do. ..	Do.	2 pieces soaked 24 hours and boiled	Do.	Do.
Deal ..	Atlas Preservative A, full strength	2 pieces painted once ..	Do	Do.
Do. ..	Do.	2 pieces painted twice ..	Do	Do.
Do. ..	Do.	1 piece, hole in centre ..	Do.	Do.
Lemon Wood	Do.	1 piece soaked 24 hours	Do.	Do.
Do.	Do.	1 piece painted once .	Do.	Do.
Blue Gum..	Do	2 pieces soaked 24 hours	Do.	Do
Do. ..	Do.	2 pieces soaked 24 hours and boiled . ..	Do	Do.
Do. ..	Do.	2 pieces painted once ..	Do.	Do.
Bockenhout	Do	2 pieces painted once ..	Do	Do.
Deal ..	Atlas Preservative A, 10% solution	2 pieces soaked 24 hours	Do.	Do
Do. ..	Do.	2 pieces soaked 24 hours and boiled	Do	Do
Do. ..	Demuth's Dip, 10% solution ..	2 pieces soaked 24 hours	Do.	1 piece slightly eaten.
Do. ..	Do.	2 pieces soaked 24 hours and boiled	Do.	Not eaten.
Do. ..	Cooper's Dip, 1 pt. to 9 gals. water	2 pieces soaked 24 hours	Do	Do.
Do. ..	Do.	2 pieces soaked 24 hours and boiled . ..	Do.	Do.
Do. ..	Alderson's Cattle Dip, 4 lbs. to 8 gals. water ..	2 pieces soaked 24 hours	Do.	Do.
Do. ..	Do	2 pieces soaked 24 hours and boiled	Do.	Do.
Do. ..	Street's White Ant Cure, 10% solution	2 pieces soaked 24 hours	Pieces were lost ..	Pieces were lost.
Do. ..	Do.	2 pieces soaked 24 hours and boiled	Not eaten ..	Eaten.
Blue Gum..	Do.	2 pieces soaked and boiled	Do.	Do.
Do. ..	Do.	2 pieces painted once ..	Slightly eaten	Do.

It will be observed from the above experiments that arsenical compounds are very effective. With the exception of one specimen treated with "Street's White Ant Cure," all pieces of wood treated with this compound were eaten by termites.

II.—Tar, Creosote, and Carbolic Acid Compounds.

Wood Employed.	Chemical used.	Treatment.	Result at first Examination, 4th June, 1907.	Result at second Examination, 21st August, 1908.
Deal ..	Coal Tar	2 pieces painted once ..	Not eaten ..	Eaten.
Do. ..	Do.	2 pieces painted twice ..	Do. ..	Not eaten.
Blue Gum ..	Do.	2 pieces painted once ..	Slightly eaten	Eaten.
Deal ..	Stockholm Tar ..	2 pieces painted once ..	Not eaten ..	Do.
Do. ..	Do. ..	2 pieces painted twice ..	Do. ..	Do.
Boekenhout	Do. ..	2 pieces painted once ..	Slightly eaten	Do.
Blue Gum ..	Do. ..	2 pieces painted once ..	Do. ..	Do
Deal ..	Creosote, 10% ..	2 pieces soaked 24 hours	Do. ..	Do.
Do. ..	Do. ..	2 pieces soaked 24 hours and boiled . ..	Do. ..	Do.
Do. ..	Creosote, full str.	2 pieces painted once ..	Do. ..	Do.
Do. ..	Do.	2 pieces painted twice ..	Not eaten ..	Do.
Lemon Wood	Do.	1 piece painted once ..	Do. ..	Do.
Deal ..	Solignum, full str.	2 pieces painted once ..	Do. ..	Do.
Do. ..	Do	2 pieces painted twice ..	Do. ..	Do.
Do. ..	Do.	1 piece, hole in centre filled	Slightly eaten	Do.
Blue Gum ..	Do	2 pieces painted once ..	Do.	Do.
Boekenhout	Do.	2 pieces painted once ..	Not eaten ..	Do.
Lemon Wood	Do.	1 piece painted once ..	Do. ..	Do.
Deal ..	Asphenite, full str.	2 pieces painted once ..	Do. ..	Do.
Do. ..	Do.	2 pieces painted twice ..	Do. ..	Do.
Lemon Wood	Do.	1 piece painted once ..	Slightly eaten	Do.
Deal ..	Crude Carbolic Acid	2 pieces painted once ..	Not eaten ..	Do.
Do. .	Do.	2 pieces painted twice ..	Do. ..	Do.
Do. ..	Do.	2 pieces soaked 24 hours	Half eaten ..	Do.
Do. ..	Do.	2 pieces soaked 24 hours and boiled	Slightly eaten	Do.
Do. ..	Do.	1 piece, hole in centre filled	Do.	Do.
Lemon Wood	Do.	1 piece painted once ..	Do.	Do.
Do.	10% sol. Carbolic Acid	1 piece soaked 24 hours	Do.	Do.
Deal ..	Jeyes Fluid, full strength ..	2 pieces soaked 24 hours	Do.	Do.
Do. ..	Do.	2 pieces soaked 24 hours and boiled	Do.	Do.
Do. ..	Jeyes Fluid, 10% solution ..	3 pieces soaked under pressure of 50 lbs. to square inch	Do.	Do.
Do. ..	Jeyes Fluid, full strength ..	2 pieces painted once ..	Not eaten ..	Do.
Do. ..	Do.	2 pieces painted twice ..	Do. ..	Do.
Do. ..	Do.	1 piece, hole in centre filled	Slightly eaten	Do.
Lemon Wood	Jeyes Fluid, 10% solution ..	1 piece soaked 24 hours	Do.	Do.
Blue Gum ..	Jeyes Fluid, full strength ..	2 pieces soaked 24 hours	Do.	Do.
Do. ..	Do.	2 pieces soaked 24 hours and boiled	Do.	Do.
Deal ..	Carbolineum, full strength ..	2 pieces painted once ..	Not eaten ..	1 piece eaten.
Do. ..	Do.	2 pieces painted twice ..	Do. ..	Do.
Lemon Wood	Do.	1 piece painted once ..	Do. ..	Eaten.
Blue Gum ..	Do.	2 pieces painted once ..	Slightly eaten	Do.

With the exception of two pieces of deal painted twice with coal tar, and one piece of deal painted once, and one piece painted twice, with carbolineum, which were quite intact, all other pieces of wood treated with tar, creosote, and carbolic acid compounds were found to be eaten at the second examination. It cannot, therefore, be recommended to use any of these tar compounds, if wood has to be treated which is expected to withstand the attacks of termites for any length of time.

III.—Tobacco Extracts.

Wood Employed.	Chemical used.	Treatment.	Result at first Examination, [illegible]th June, 1907.	Result at second Examination, 21st August, 1908.
Deal	Transvaal Tobacco Extract, 10% sol.	2 pieces soaked 24 hours	Slightly eaten	At the second examination all these pieces were found to have been eaten.
Do. ..	Do.	2 pieces soaked 24 hours and boiled .. .	Do.	
Lemon Wood	Do.	2 pieces soaked 24 hours and boiled .. .	Slightly to half eaten ..	
Blue Gum..	Do.	2 pieces soaked 24 hours and boiled ..	Slightly eaten	
Deal .	French Tobacco Extract ..	2 pieces soaked 24 hours	Do.	
Do. ..	Do.	2 pieces soaked 24 hours and boiled .. .	Do.	
Do. .	Do	1 piece painted once .	Do.	
Do.	Austrian Tobacco Extract .	2 pieces soaked 24 hours	Do.	
Do.	Do.	2 pieces soaked 24 hours and boiled .. .	Do.	
Do. .	Do.	1 piece painted once ..	Do	
Lemon Wood	Austrian Tobacco Extract, 10% sol.	1 piece soaked 24 hours	Half eaten ..	
Deal ..	Switzerland Tobacco Extract	2 pieces soaked 24 hours	Do.	
Do.	Do.	2 pieces soaked 24 hours and boiled .. .	Do.	
Do. .	Laidlaw's Tobacco Extract ..	2 pieces soaked 24 hours	Slightly eaten	
Do. .	Do.	2 pieces soaked and boiled	Do.	

Tobacco extracts of all sorts seem worthless for this purpose. None of them contain more than an average of 8 per cent. of nicotine, and this is easily washed out by water in the soil, leaving the wood entirely unprotected.

IV.—Oils and Paints.

Wood Employed.	Chemical used.	Treatment.	Result at first Examination, 4th June, 1907.	Result at second Examination, 21st August, 1908.
Deal ..	Raw linseed oil ..	2 pieces painted once ..	Slightly eaten	At the second examination all these pieces were found to have been eaten.
Do. ..	Do. ..	2 pieces painted twice ..	Do.	
Do. ..	Do. ..	1 piece, hole in centre filled	Do.	
Boekenhout	Do. ..	4 pieces painted once ..	Half eaten .	
Deal ..	Raw linseed oil and red lead ..	2 pieces painted once ..	Not eaten ..	
Do. ..	Do.	2 pieces painted twice ..	Do. ..	
Do ..	Raw linseed oil and white lead	2 pieces painted twice .	Do ..	
Do. ..	Raw linseed oil and lampblack	2 pieces painted once ..	Do. ..	
Lemon Wood	Raw linseed oil and resin ..	1 piece painted once ..	Half eaten ..	
Deal ..	Raw linseed oil and red lead and arsenite of soda	2 pieces painted once ..	Not eaten .	
Do. ..	Raw linseed oil, white lead, and arsenic (white)	2 pieces painted once ..	Do. ..	
Do. .	Do.	2 pieces painted twice ..	Do.	
Lemon Wood	Raw linseed oil, red lead, and arsenite of soda	1 piece painted once ..	Do. ..	
Do.	Red lead (paste)	1 piece painted once ..	Do. ..	
Do.	Red oxide of iron and raw linseed oil	1 piece painted once ..	Slightly eaten	
Deal ..	Do.	2 pieces painted once ..	Not eaten .	
Do. ..	Do.	2 pieces painted twice ..	Do. ..	
Lemon Wood	White lead (paste) and white arsenic	1 piece painted once ..	Do. ..	
Deal ..	Paraffin	1 piece, hole in centre filled	Slightly eaten	
Do. ..	Crude castor oil ..	2 pieces painted once ..	Do.	
Blue Gum..	Do. ..	2 pieces painted once ..	Half eaten ..	
Deal ..	Castor oil emulsion	2 pieces soaked 24 hours	Slightly eaten	
Blue Gum..	Do.	2 pieces soaked 24 hours and boiled	Half eaten ..	
Boekenhout	Do.	2 pieces soaked 24 hours	Do. ..	
Deal ..	Castor oil emulsion and creosote, equal parts ..	2 pieces painted once ..	Slightly eaten	

It will be observed from the above two tables (III and IV) that tobacco extracts, oils, and paints are useless for the purpose of preserving wood against the ravages of termites.

V.—Soaps.

Wood Employed.	Chemical used.	Treatment.	Result at first Examination. 4th June, 1907.	Result at second Examination, 21st August, 1908.
Deal .	Blue mottled soap, 10% solution ..	2 pieces soaked 24 hours	Slightly eaten	Eaten.
Do. .	Do.	2 pieces soaked 24 hours and boiled	Do.	Do.
Do. .	Blue mottled soap, 5% solution ..	2 pieces soaked 24 hours	Not eaten ..	Do.
Do. ..	Blue mottled soap, plus 5% solution arsenite of soda	2 pieces soaked 24 hours and boiled	Do. ..	Do.
Do. ..	Resin wash and water, equal parts	2 pieces soaked 24 hours	Slightly eaten	Do.
Do. ..	Do.	2 pieces soaked 24 hours and boiled	Do.	Do.
Do. ..	Paraffin emulsion, 10% solution ..	2 pieces soaked 24 hours	Do.	Do.
Do. ..	Do.	2 pieces soaked 24 hours and boiled	Do.	Do.
Do. ..	Paraffin emulsion, 5% solution ..	2 pieces soaked 24 hours	Do.	Do.
Do ..	Paraffin emulsion, plus 5% solution arsenite of soda	2 pieces soaked 24 hours and boiled	Do.	Do.

Nothing can be said in favour of soaps for this purpose. They are easily washed out by water, and in themselves would not render the wood either distasteful or poisonous.

VI.—Copper Sulphate (Blue-Stone).

Wood Employed.	Chemical used.	Treatment.	Result at first Examination, 4th June, 1907.	Result at second Examination, 21st August, 1908.
Deal ..	Saturated solution copper sulphate	2 pieces soaked 24 hours	Not eaten ..	Not eaten.
Do. ..	Do.	2 pieces soaked and boiled	Do. ..	Do.
Do. ..	5% solution copper sulphate ..	4 pieces soaked 24 hours, then boiled and later soaked 24 hours in a solution of freshly-slaked stone lime ..	Slightly eaten	Slightly eaten.
Do. ..	Copper sulphate crystals ..	1 piece, hole in centre plugged and filled up	Do.	Do.
Do. ..	Do.	1 piece, hole slanting from side, filled and plugged up	Half eaten ..	Eaten.
Blue Gum..	Copper sulphate 10% solution ..	2 pieces soaked 24 hours in hot solution ..	Slightly eaten	Do.
Do. ..	Do.	2 pieces soaked 24 hours in cold solution ..	Do.	Do.
Boekenhout	Do.	2 pieces soaked 24 hours in cold solution .	Do.	Do.

The pieces of wood which had been thoroughly soaked in an absolute copper sulphate solution withstood the attacks of the termites, whereas those pieces which were only slightly treated were eaten.

The following chemicals were also tested:—Mercuric chloride, calcium chloride, sulphuric acid, sulphate of iron, sulphate of soda, hyposulphite of soda, carbonate of soda, alum and salt: these, however, proved to be useless after two years' test.

Immunity of Native Woods.

The question of immunity of native and South African woods is often discussed. To obtain some accurate information on this point as many native woods as possible were obtained and buried along with the other pieces used in this experiment. They were not treated with any chemicals, and the following list shows the results obtained. Some pieces of imported woods were also included.

WOODS, NATIVE AND IMPORTED, UNTREATED.

			Result at first Examination, 4th June, 1907.	Result at second Examination, 21st August, 1908.
3 pieces	Xymalos monospora ..	Lemon Wood ..	Slightly eaten	Eaten.
3 ,,	Faurea saligna	Boekenhout	Do.	Do.
2 ,,	Acacia pallens	Knoppiesdoorn ..	Do.	Do.
4 ,,	Rhamnus Zeyheri ..	Red Ivory	Do.	Do.
1 piece	Trichocladus grandiflorus	Onder Bosch (Natal)	Do.	Do.
2 pieces	Duguetia quitarensis ..	Lancewood	Do.	Do.
6 ,,	Combretum porphyrolepis	Leadwood	Not eaten ..	Not eaten.
2 ,,	Adina Galpini	Nhlume, Matoma or Mohambo	Do. ..	Do.
2 ,,	Excoecaria africana ..	Tambootie	Do. ..	Eaten.
3 ,,	Olea laurifolia .. .	Black Ironwood ..	Do. ..	Not eaten.
2 ,,	Rhus viminalis	Kariwood	Do. ..	Eaten.
2 ,,	Ocotea bullata (?) ..	Stinkhout	Do. ..	Do.
2 ,,	Ptaeroxylon utile ..	Sneezewood	Do. ..	Do.
3 ,,	Pygeum africanum ..	Bitter Almond ..	Very slightly eaten ..	Do.
3 ,,	Ochna arborea	Cape Plane	Half eaten ..	Do.
3 ,,	Podocarpus Thunbergii	Yellow Wood ..	Do. ..	Do.
3 ,,	Podocarpus elongata .	Bastard Yellow Wood	Do. ..	Do.
3 ,,	Kiggelaria africana ..	Speckhout	Slightly eaten	Do
3 ,,	Curtisia faginea ..	Assegaihout	Half eaten ..	Do.
3 ,,	Gymnosporia deflexa ..	Transvaal Saffron Wood	Slightly eaten	Do.
3 ,,	Apodytes dimidiata	White Pear	Do.	Do
2 ,,	Scolopia Mundtii ..	Red Pear	Do.	Do.
3 ,,	Brachylaena discolor ..	Vaal Bosch	Do.	Not eaten.
2 ,,	Casuarina	Casuarina	Half eaten	Eaten.
3 ,,	Calodendrum capense ..	Chestnut	Slightly eaten	Do.
2 ,,	Swietenia mahogani .	Mahogany (American)	Not eaten ..	Do
3 ,,	—	Apple Wood	Half eaten ..	Do.
2 ,,	Carya alba and carya sp	American Hickory ..	Do. ..	Do.
2 ,,	Liriodendron tulipifera..	Poplar	Do. ..	Do
2 ,,	Fagus sylvatica.. ..	English Beech ..	Do. ..	Do.
2 ,,	Quercus pedunculata ..	English Oak	Slightly eaten	Do.
2 ,,	Quercus alba	American Oak ..	Do.	Do.
2 ,,	Fraxinus excelsior ..	English Ash	Do.	Do.
2 ,,	Fraxinus americana ..	American Ash ..	Half eaten	Do.
2 ,,	Pseudotsuga Douglasii..	Oregon Pine	Not eaten ..	Do.
1 piece	—	Lapashi (S. American)	Do. ..	Do.
4 pieces	—	Hard Woods	Do. ..	Do.

The same pieces of wood were buried again, and another inspection will be made next year and reported upon.

III. THE BROWN LOCUST CAMPAIGN, 1908-09.

By F. Thomsen, Assistant Chief Locust Officer, Division of Entomology.

(Plates 81, 82, and 83.)

Reports of egg-laying had been received during the months of June and July from the following districts:—Pretoria, Rustenburg, Potchefstroom, Marico, Waterberg, Wolmaransstad, and Bloemhof.

Towards the end of September the first rainfall of the season was reported, and it was considered advisable to start the destruction work against the brown locusts by appointing District Locust Officers in the abovementioned districts from the 1st October, 1908.

All the men appointed were acquainted with the work of destruction, having had previous experience in former campaigns. Their first duties were to make themselves acquainted with the local conditions pertaining to their various districts, make a thorough inspection, and arrange details regarding the transport of the destruction material. A large quantity of this material had already been stored away in the infested districts in charge of Resident Magistrates, Field Cornets, and Police Officials from the previous season's locust campaign. Spray pumps, after having been overhauled and put in thorough working order, were forwarded to the infested areas, and we were thus fully prepared for all emergencies.

Although the early rains were sufficient to cause the locust eggs to hatch out, it appears that the cool weather which followed these rains retarded their development.

The first appearance of voetgangers was reported from Marico District in the middle of October: shortly afterwards reports came in from Pretoria, Rustenburg, Waterberg, Bloemhof, Wolmaransstad, and Potchefstroom Districts.

On the 20th October, 1908, the Resident Magistrate, Lichtenburg, advised this office that voetgangers had been seen on several farms in the district. This was unexpected, as no reports of egg-laying had been previously recorded from that district. Careful investigation, however, was made, and it was found that these locust eggs must have been laid during the season of 1907. There was only a very light rainfall in this district during the year 1907, which had evidently proved insufficient to develop the eggs. The Resident Magistrate undertook to have these swarms of voetgangers destroyed, but in November the swarms became so numerous that he asked for more assistance. A District Locust Officer was immediately appointed, and the destruction work was completed without delay.

The following is a tabulated list of the various locust officers appointed to carry out the work of destruction; it must, however, be pointed out that not all of them worked during the whole of the campaign, and several of the assistants were only appointed where it

was found necessary, the majority being engaged towards the termination of the campaign:—

District.	D.L.O.	Sub-D.L.O.	Asst. L.O.
Rustenburg	1	1	3
Marico	1	—	2
Bloemhof and Wolmaransstad ...	1	2	1
Potchefstroom ...	1	—	1
Pretoria	1	2	18
Waterberg	1	1	15
Lichtenburg	1	—	1
	7	6	41

Total number, 54.

The Locust Officers received great help from farmers and natives in all the infested districts, and it was generally recognised that the destruction work against the voetgangers was of the greatest utility.

In order to give warning of the fact that poisonous spray was being used, and thus to allow opportunity for farmers to move or herd their cattle, white calico flags, on which was printed a general warning in both English and Dutch were, for the first time this season, distributed to all locust officers. From reports received these flags appear to have been of the greatest help in minimising the number of stock-poisoning cases. Notices were also issued for distribution by locust officers intimating that spraying with a poisonous solution was in progress on certain farms, and warning the farmer what action to take in order to avoid accidents The distribution of these notices, however, although of great service in warning the neighbours where spraying had been done, occupied a great deal of the time of the locust officers, and thereby caused some inconvenience.

Sveral cases of poisoning of stock were reported in spite of every precaution and though farmers were well acquainted with the poisonous nature of the arsenite of soda spray. The most thorough investigations were made in every instance, and it was found that carelessness on the part of one person or another was the cause of the poisoning of the stock in every instance. Many of the sufferers were people who could ill afford such loss. It appeared that the want of salt, in many cases, drove the stock on to the sprayed areas. In the Bloemhof, Wolmaransstad, Lichtenburg, and Rustenburg Districts, no poisoning of stock occurred. From Potchefstroom and Marico only one case in each district was reported, the remaining cases happening in Waterberg and Pretoria Districts.

The arsenite of soda spray sweetened with brown sugar and treacle was again used and found to be effective. A new spraying compound called "Locusticide" was thoroughly tested and found to be very economical and effective, the advantages of this compound being

(1) it readily mixes with cold water;
(2) no residue is left in the buckets or tins after the operations are finished;

(3) the locusts seem to be attracted by the compound and will not leave the sprayed areas;
(4) the cost is the same as the older arsenite of soda spray, viz., from ½d. to 1d. per gallon, depending upon the strength used.

Further, there is the advantage that the "Locusticide" spray cannot be used for any other purpose than spraying against insects, whereas the sugar or treacle and arsenite of soda will often be utilised for other purposes unknown to the locust officers, and thereby might cause accidents.

Experiments were also made with a new by-product of the sugar refineries called "Molascuit." The Molassine Co., Durban, were good enough to forward us five bags of this compound for experimental purposes. The compound is made from the pith of the sugar cane as it comes from the mill, being mixed again, after leaving the mill, with molasses.

Experiments with "Molascuit."

No. 1. 100 lbs. of "Molascuit" were thoroughly mixed with four gallons of water, in which four ounces of arsenite of soda had been dissolved.
No. 2. 100 lbs. of "Molascuit" were also moistened with four gallons of water in which a sixth part of a gallon of "Locusticide" had been dissolved.

No. 1 was spread broadcast between three swarms of voetgangers measuring about 100 yards by 150 yards each. All voetgangers were killed within a day. Some of the "Molascuit" was, however, found on the ground two days afterwards.

No. 2 was spread between one large and one small swarm of voetgangers, the large swarm covering an area of about 800 yards by 600 yards, and the small swarm about 200 yards by about 150 yards. The voetgangers ate the poisoned "Molascuit" readily, and died within two days. In this case also some of the "Molascuit" remained on the ground.

From the foregoing it will be seen that it would not be advisable to destroy voetgangers with the poisoned "Molascuit" in areas where stock are numerous. But in locations far removed from water, and uninhabited, good results could be obtained.

The following is a short description of the work done in each of the various districts infested:—

Pretoria District.—The work against the voetgangers in this district was of greater magnitude than was anticipated at the commencement of the campaign. The officials in charge of the work carried out the various duties allotted to them well, but could have accomplished the work with greater despatch if the information of the whereabouts of voetgangers had been supplied more promptly. Notwithstanding the rough, bushy nature of the localities in which the work was carried on, and the great distances in which water had to be conveyed, good work was done.

No damage was done to crops, but a few of the swarms obtained wings, and were immediately set upon by the locust birds. They were not allowed to settle for food, in fact, so persistent were the attacks of these birds upon the locusts that they were even observed

travelling at night time, an incident which has not heretofore been noticed in the Transvaal. All of these swarms were subsequently destroyed. The total number of swarms killed by officers amounted to 1,558, and by farmers and natives 100.

Rustenburg.—It was anticipated that swarms of voetgangers would have hatched out in the northern portions of this district. The district locust officer paid various visits to the localities in that part, but no voetgangers could be found; this naturally occupied a great deal of his time. The western parts, in the Zwaartruggens Ward, were infested with voetgangers. The number of swarms killed by officials is put down at 20, and those killed by farmers at 196. In this district also a great number of locust birds participated in the work of destruction. No damage was done to crops.

Potchefstroom.—The work of destruction was very successfully carried out in this district and not a single swarm escaped. Not only the farmers and natives, but also the managers of companies' properties worked hard. In some isolated cases the farmers were somewhat slow and unwilling to work, but these difficulties were soon overcome by the tact and resourcefulness of our locust officers, and the latter ultimately received all the assistance necessary. On account of the scarcity of water, not many swarms were killed by the use of the arsenical spray, the majority of voetgangers being destroyed by grass fires; the locust birds accounted for a great many swarms. The number of swarms killed by officials in this district was 40, and by farmers and natives 510.

Marico.—Good destruction work was accomplished in this district by the locust officers, but it should be recorded that many of the farmers could have rendered more energetic assistance. In his final report the District Locust Officer states that the use of the flags was very generally approved of, and goes on to state that he strongly recommends the continuance of the present methods of destruction, but he considers that greater pressure should be brought to bear in getting landowners and occupiers to report all egg laying, and particularly the appearance of voetgangers and the locating of swarms during the campaign. Officials were accountable for 106 swarms, farmers 60, and natives 9 swarms in this district.

The employment of natives in catching locusts has great disadvantages as well as advantages. In the first place, it induces them to withhold from locust officers the necessary information, and, secondly, it usually divides the swarm into several smaller ones moving about in different directions, and these become more difficult to treat.

Wolmaransstad and Bloemhof.—For the sake of convenience both of these districts were worked by one district locust officer and his assistants. The areas of infestation were to the north of Wolmaransstad and along the southern and western banks of the Harts River, extending over a distance of over forty miles in length. On account of the great scarcity of water in these districts our district locust officers and the farmers experienced great difficulty in carrying out the work. In the two districts 95 swarms were destroyed by locust officers, and 632 by farmers and natives. Towards the end of the campaign heavy rains fell and the true locust birds (*Glareola*) made their appearance and exterminated the few swarms which escaped

the vigilance of our locust officer and farmers. Hardly any damage was done to crops by locusts.

Waterberg District.—At first it was considered that the bushveld to the north along the Palala and Pongola Rivers, whence reports had been received, were infested, but such reports subsequently proved to have been incorrect. The south side of the Nijl River down to the Springbokflats and towards Schilpadfontein were infested with voetgangers; some of these appeared to have been crossing over from the Pretoria District. The locust officers worked well; some swarms, however, obtained wings and travelled some distance towards Rooiberg and the Crocodile River Valley. All these swarms were subsequently destroyed by various locust birds. In every locust campaign it will happen that some swarm or other will be overlooked and will obtain wings. This danger, however, could be greatly lessened if farmers and natives would render greater co-operation in connection with the locust destruction work. The number of swarms destroyed by the locust officers, farmers, and natives amounted to 1,000, and the damage done to crops was very small.

Lichtenburg District.—As stated before, the destruction work in this district did not start before the month of November. The locust officers killed 100 swarms, farmers and natives 504. Both farmers and natives co-operated well with our locust officers, and no reports of loss of any crops were received.

SUMMARY OF SWARMS DESTROYED BY LOCUST OFFICERS, FARMERS, AND NATIVES.

Name of District.	Number destroyed by Locust Officers.	Number destroyed by Farmers and Natives.
Pretoria District	1,558	100
Rustenburg District	20	196
Marico District	106	60
Wolmaransstad and Bloemhof Districts	95	632
Potchefstroom District	40	510
Waterberg District	1,000	—
Lichtenburg District	100	504
	2,919	2,002

Total number of swarms destroyed: 4,921.

SUMMARY OF EXPENDITURE, ETC., OF BROWN LOCUST DESTRUCTION WORK—OCTOBER TO DECEMBER, 1908.

Salaries, Transport, and Sundries.	Cost of Material used.	Arsenite of Soda used.	Sugar used.	Treacle used.	Number of Swarms Destroyed.	Number of Men Employed.
£2,765	£200 6 6	7,819 lbs.	8,182 lbs.	6,242 lbs.	4,921	54

LOCUST BIRDS.

Special mention should be made of the great assistance rendered by the various locust birds during the recent campaign.

It was during the month of November that large numbers of the white stork (*Ciconia alba*) made their appearance. At first they did not destroy many living swarms, but fed more or less on those which were dead or dying from the effects of the arsenical spray. In no cases were any dead storks to be seen; they seem to stand the small doses of arsenic quite well. Somewhat later the white-bellied stork (*Abdimia abdimii*) came from the north; these birds also appeared in huge flocks, and helped to destroy the voetgangers.

Naumanns kestrel (*Tinnunculus naumanni*) had never been seen before in such large numbers, and although they are slow feeders, they killed a great number of locusts.

The two other South African kestrels (*Tinnunculus rupicola* and *T. rupicoloides*) were also present in numbers.

The yellow-billed kite [*Milvus ægyptius* (Gm.)] appeared this year in such great flocks that even the natives remarked upon their prevalence. All these birds of prey helped in the destruction of the voetgangers.

The true locust bird (*Glareola*) was very prevalent in the southern and western districts, and many flying swarms which came from the south were destroyed by them. Guinea fowls, pheasants, sprews, and some finches also helped to diminish the numbers of voetgangers.

It is believed that the reason we were visited by such great numbers of various locust-eating birds was that in the interior, in the north, the locust swarms were very few; the reports from the Zambesi indicate this, consequently the birds were found to travel southwards to find food. They came to the Transvaal, and helped to destroy the swarms here and further south. All this points to the probability that very few flying swarms of brown locusts will be met with during next season south of the Zambesi.

The locust birds are now protected by law. Yet, very often, wanton destruction of them takes place both in towns and on farms. Small boys with catapults, and grown-up people with guns, have been seen killing some of these useful birds for pastime.

Legislation.

Whilst the heartiest co-operation was rendered by the majority of the farmers in connection with the destruction work, many of them are of the opinion that legislation should be enacted for the purpose of bringing those farmers into line who do not fully realise the importance of this work, and in this manner tend to greatly minimise the danger of swarms of voetgangers obtaining wings in certain districts.

As previously stated in this report, locust birds rendered valuable assistance in the destruction both of voetgangers and flyers, but such assistance cannot always be depended upon in future campaigns.

Map No. 1 shows the areas from which reports of egg laying were received, and Map No. 2 shows the areas where voetgangers actually appeared.

Plate 81.

Flags used to warn farmers that poisonous spray has been used for voetgangers.

No. 1.

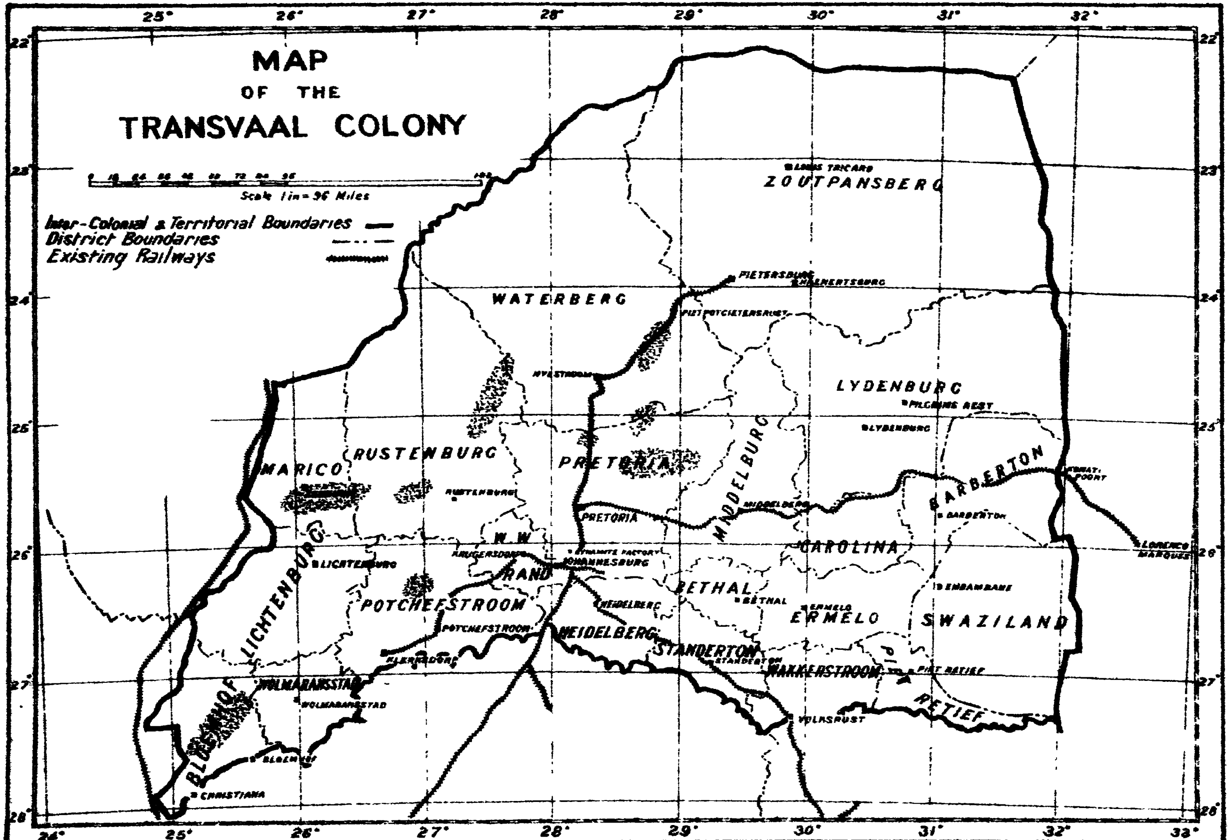


Plate 82.

Brown Locust.

Egg-laying Area.—Season 1908.

No. 2.

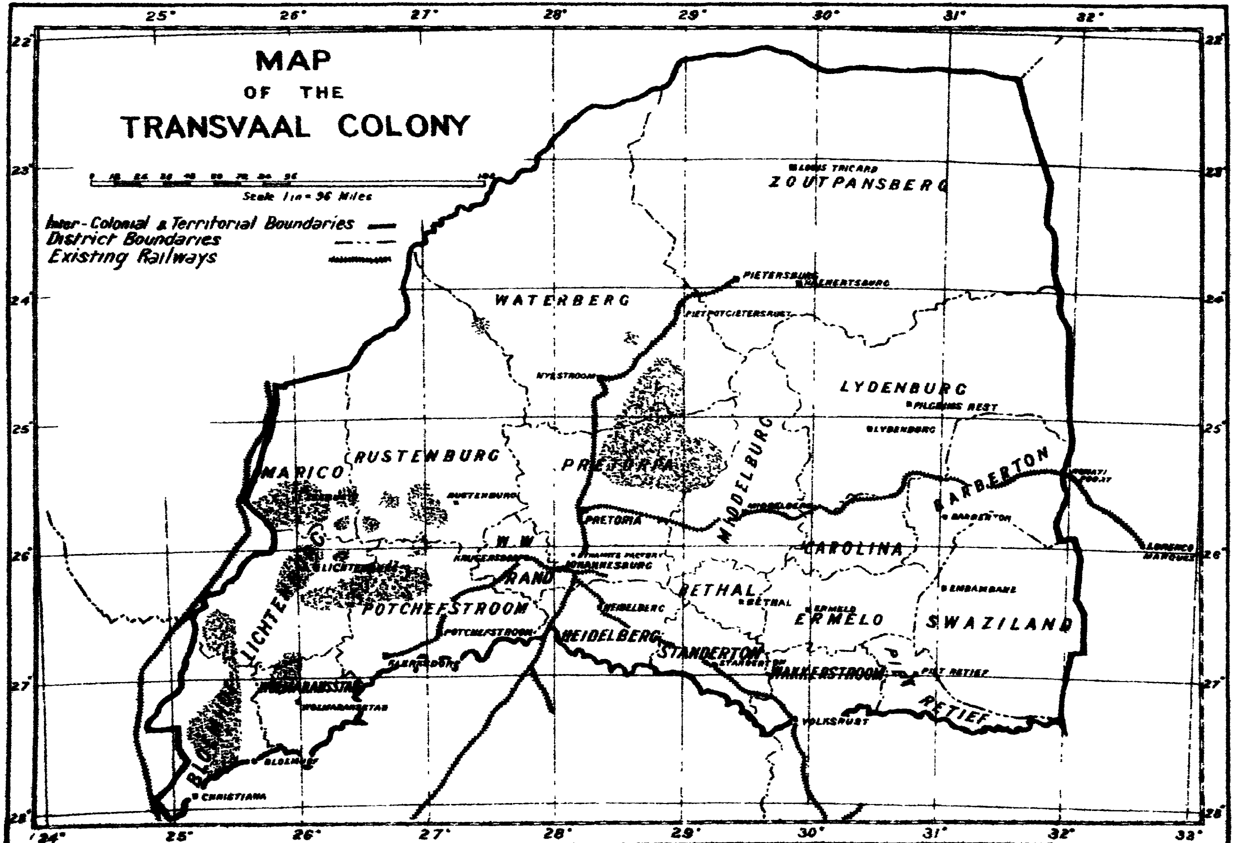


Plate 83

Locust Campaign.

Voetgangers of the Brown Locusts.—Season 1908-09

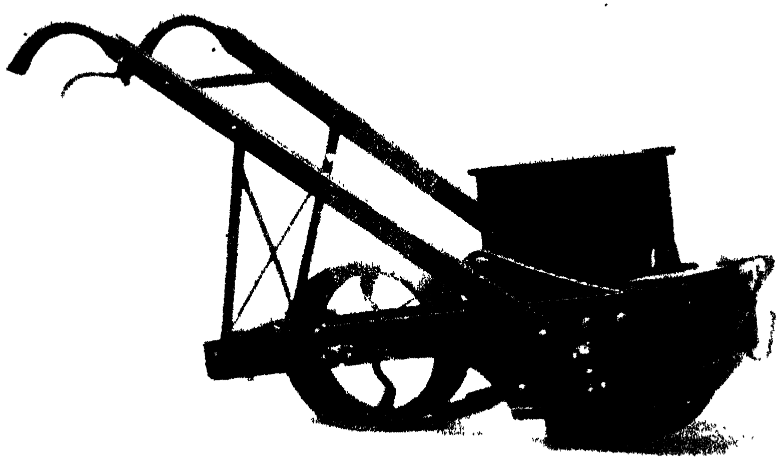


Fig. 1.—A peanut planting machine.

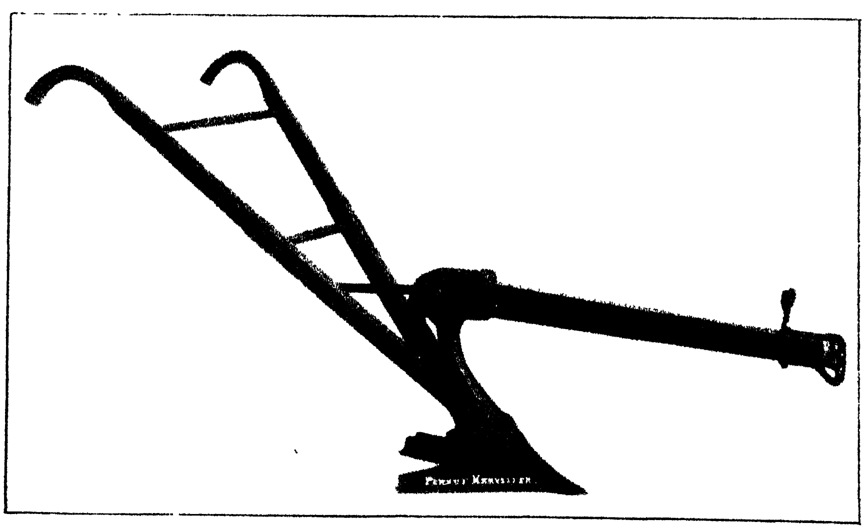


Plate 84.

Fig. 2. A peanut harvesting plough.

The Household Science Section.

I.—SOME POINTS IN CONNECTION WITH A TEACHER'S DUTIES.

By Matilda T. Gilchrist-Clark, Certificated Teacher of Cookery.

The teaching of domestic economy takes a high place in all modern schemes of education. A very considerable sum has been expended by various governments on the advancement of this subject. Even before the matter was taken up by Imperial and municipal bodies, private persons had done what they could in the direction of teaching young people the rudiments of cookery and housework. This was chiefly carried out in poor city districts or in remote country places, and the teachers were frequently ladies of education, or their professional cooks—the work always being practically a form of philanthropy.

Nowadays such isolated and individual efforts are rare, and the business is almost entirely in the hands of educational authorities. The object which all such authorities set before themselves is this: To teach every child, according to its probable station in life, to deal with domestic arrangements in the wisest possible way; to equip it with such knowledge and skill that it may gain the fullest advantage from what lies at its disposal, wasting neither time, labour, nor material.

It is obvious that this result—an all-round training in economy—cannot be completely attained in a few months, or even in a few years, when we consider the limited number of hours per week which are commonly allowed to the domestic subjects. This very fact, however, makes it the more important that the amount of time permitted to be so employed should be occupied exclusively in the right direction.

In Great Britain, where, perhaps more than in other countries, it is necessary to combat a national tendency towards waste in small matters, the organised teaching of cookery has not been entirely productive of the desired result. In fact, comparing the amount of organised instruction with the apparent increase of general knowledge on the subject (so far as such a comparison is possible), the game would hardly seem to have been worth so costly a candle.

It is to be hoped that in South Africa, where many heavy demands must necessarily be made upon public finances, authorities may profit by the experience of Great Britain, and certain pitfalls may be avoided.

It is of the first importance that a teacher should be thoroughly and sympathetically acquainted with the pupils' home circumstances. I have known instances where a teacher has given courses of cookery lessons, constantly introducing baked forms of food, to pupils who had no ovens in their homes, and who consequently could not put their lessons into practice. I have seen teachers of laundry work giving demonstrations to children of the poorest class, and constantly assuming throughout their teaching an amount of free space which is never available in such homes as those of the pupils. In consequence,

systems were advocated which could not be carried out on such premises. Thus not only was time wasted for both teacher and pupil, but an undesirable moral impression was also produced, namely, that authorised instruction in all domestic matters was unpractical and not likely to be of service.

Before setting out any scheme of teaching then, it is exceedingly desirable that the authorities should make a careful and exact enquiry into the home circumstances of those who are to learn, and see that the teacher also is informed upon this point. Then, in the time at command, such things only should be taught as will be likely to make the home life of the pupils more comfortable, without causing too heavy a drain upon either time, labour, or material.

The object of all domestic teaching should be to fit women to become more efficient in their own homes, and not merely to enable little girls to pass cookery and laundry examinations.

The greatest thing the teacher can do is to awaken and develop instincts which exist in every woman—the instincts of feeding, clothing, repairing, and cleansing—the desire to make home as attractive a place as may be. There is a natural desire also, not thoroughly developed in every woman, but exceedingly strong—for instance, in the French peasant—to make material and money go as far as possible. All such matters are, for a normal woman, not wearisome, but of absorbing interest. To a very simple, uncultivated nature they are interesting as ends in themselves. To a more developed being they become even more interesting, because they are recognised as means to certain highly important ends.

So long as soul is temporarily connected with body, so long will physical and domestic conditions exert a highly important influence on mental and moral activities—how important it is hardly possible to estimate. The teacher, then, has to be herself an enthusiast for her subject—as every teacher is who is worthy of the name—and she will therefore grudge no conceivable trouble to awaken the dormant powers, and strengthen the possibilities for happy effectiveness, which exist in her pupils.

More especially are such enthusiasm and such pains necessary in South Africa. The country is passing through a highly important period of development. Life for almost all South Africans bristles with difficulties, not least among which are those small, but irritating, hindrances which spring from the unsatisfactory adjustment of domestic life. Many articles in daily use are costly, the country not yet producing as much as should be produced for home consumption. In certain districts the climate has peculiar effects on those who live there, causing in some cases lethargy, in others nervous instability, in others a tendency to alcoholism. Poverty, in some form or other, presses almost universally.

It is of the first importance then that teachers of cookery and kindred subjects should be thoroughly acquainted with the difficulties and needs of those they have to teach; that they should disabuse the minds of their pupils of that idea—common enough nowadays, unfortunately—that domestic subjects are beneath the attention of educated women; that they should point out to them the far-reaching importance of each detail of their daily work, and show them that home life at every turn touches upon public life, and the one must inevitably affect the other for good or evil.

The Germans have a proverb to the effect that a man is what he eats. Brillat-Savarin asserted that nothing predisposed the mind better to a profitable discussion of public business than a dinner well conceived and artistically prepared. He should have added that strict moderation in the enjoyment of the said dinner was also a necessary condition of its good effect. It may be, undoubtedly it is, to the credit of the Englishman that he knows and cares so little about his food in comparison with the majority of his Continental neighbours. But it can only be a disgrace to the Englishwoman that the same should be said of her.

A very important piece of work lies before her, and especially before the trained teacher of cookery, whose efforts, if wisely directed, may materially help to ease the burdens which press on the shoulders of both men and women in this country.

II.—RECIPES FOR THE FARM HOME.

Pickled (or Ingelegde) Fish.

Ingredients: 2 good-sized soles, or any nice Cape fish (filleted), 6 large onions, 2 ozs. curry powder, 6 large chillies, 1 quart vinegar, salt to taste.

Fry the fish a nice brown in lard or butter: drain and cool. Slice four onions, and fry a nice brown; add 1 oz. curry powder, two chillies cut fine, and a dessertspoonful salt; when stirred to a paste add a little vinegar to moisten well. Lay the fish in a jar, and pour the above mixture over. Cut the rest of the onions in rings; boil in the vinegar very gently, until quite tender, with the other ounce of curry powder, a little salt, and a few lemon leaves; then pour it over the fish. It will be fit for use in three or four days, and will keep for months.

Cold Meat Shape.

Butter a plain mould, chop up any kind of cold meat you may have, add some stock, warmed, with about 3 ozs. of gelatine; season with pepper, salt, lemon juice, and thyme. Have some hard-boiled eggs cut in quarters, garnish the mould with them, pour the mixture into the mould. Turn out when cold.

* * * *

Sasaties.

Take the thick part of a leg of mutton, cut lean and fat into small square bits, and put into a large bowl. Mince a raw onion, and mix with a tablespoonful of brown sugar, half a cup of milk, and some lemon leaves; then pour over the meat. Take three or four onions, cut up, and fry in a pan with a spoonful of fat or butter to a nice brown. Take an ounce of tamarinds, pour on it a cup of boiling water; when all the strength has gone out of it, strain, mix with the onions, and let it boil; then add two spoonfuls of good curry powder; mix well together and pour over the meat. Next morning put the meat on skewers, fat and lean alternately. Carefully take all the sauce, put it into a saucepan, and boil it up. Roast the sasaties on a gridiron heated on wood coals, and serve with sauce. Instead of tamarind half a cup of vingear may be used.

BOBOTEE.

Ingredients: *2 lbs. meat, 2 onions, large slice white bread, 1 cup milk, 2 eggs, 2 tablespoonfuls curry powder, 1 dessertspoonful sugar, juice of 1 lemon, or 2 tablespoonfuls vinegar, butter.*

Mince the meat, soak bread in milk, and squeeze out dry. Fry onions in a tablespoonful butter or dripping. Mix all ingredients—curry powder, sugar, salt, vinegar, or lemon juice, etc.—with fried onion. Now mix all with the meat and soaked bread, add one egg to the mixture, whisk the other with some milk, and pour over the whole after being put into a buttered pie-dish, with a few lemon or bay leaves. Put in oven to bake. This dish is equally good made of cold mutton. One ounce of tamarinds soaked in half a pint of boiling water, then strained, and used instead of vinegar, gives a very pleasant acid flavour.

* * * *

EGG BORDER WITH RICE AND CURRY SAUCE.

Stir 4 eggs together, add ¾ of a cup of rich milk, salt and pepper to taste. Have a border-mould well buttered and sprinkled with finely-minced parsley, pour the mixture into it, set in a pan of boiling water in the oven, cover, and let it cook until firm—from five to ten minutes. Have ready some rice, boiled twenty minutes in plenty salted water, and well drained, and a cream sauce into which a slightly heaping teaspoon of curry powder has been stirred. Turn the egg-border out on a hot platter, fill the centre with rice, pour some of the sauce over it and the rest around the border. Garnish with parsley and serve at once.

* * * *

CHEESE PUDDING.

One tablespoonful of grated cheese, a cup and a half of grated bread. Mix and pour on one pint of boiling milk, adding a small bit of butter the size of a walnut. When the mixture is nearly cold, add two beaten eggs. Pour into a pie dish and bake a nice brown. Serve hot.

* * *

CHEESE OMELET.

Ingredients: *4 eggs, 1 oz. butter, 2 ozs. grated cheese, 4 spoonfuls milk, salt and cayenne pepper to taste.*

Beat eggs with milk, salt, and cayenne pepper, and fry in pan with butter. When omelet is done, spread two-thirds of the cheese over it and roll up. Serve on a hot dish, and sprinkle rest of cheese over.

* * * *

STUFFED POTATOES.

Select some sound potatoes of equal size, wash them very thoroughly, and bake them in a well-heated oven. Cut a small piece from the top of each and carefully remove the inside, taking care not to break the skin; add some butter (allowing a liberal quantity) and milk to the potato, pass it through a masher and beat it until it is light and creamy; season it well with celery or parsley, salt, pepper, and nutmeg, and add some beaten egg (the latter may be omitted). Replace sufficient of the potato to half fill the skins, pressing it firmly against the side with the handle of a small spoon, and fill the middle

with a delicately flavoured mince; put a small piece of butter on the top of each potato where the opening is, then scatter with browned crumbs, and place in a quick oven for about ten minutes. The mashed potato which is left can be utilised for potato rissoles.

* * * *

Orange Layer-Cake.

Beat two cupfuls of sugar and one of butter to a cream, add the yolks of two eggs, well beaten, with a cupful of milk and three cupfuls of sifted flour, mixed with a teaspoonful of baking powder; lastly, add the whisked whites of eggs, and a little flavouring. Bake in two layers one inch thick. For the filling take the grated rind and juice of two oranges, one cupful of sugar, and two dessertspoonfuls of corn-flour, mixed with cold water; add one cupful of boiling water. Mix all well together, and cook till thick. When cool, colour half with cochineal, and put alternate layers of pink and yellow.

* * * *

Dried Apple Cake.

Soak two cups of dried apples, and, when tender, add one cup of raisins, one cup of molasses, one cup of sugar, a little cinnamon and cloves, and boil together. When cool add one cup of sour milk, one cup of butter, two eggs, and two liberal cupfuls of flour carefully sifted two or three times. A teaspoonful of soda should also be added, either sifted with the flour or dissolved in the sour milk. Bake for two hours. This cake keeps some time and improves with age.

* * * *

Ice Cream Cake.

Ingredients: *1 cup sugar, ½ cup butter, ½ cup milk, 1¾ cups flour, 1 teaspoonful baking powder, 3 eggs, ½ tablespoonful vanilla.*

Cream the sugar with butter, add the milk, then the flour sifted with baking powder. Beat well and fold in the whites of eggs, and add vanilla. Bake in two round tins from twenty to thirty minutes. Frost with the yolks of two eggs thickened with confectioner's sugar and flavoured with vanilla. This same cake recipe, flavoured with almond extract and frosted with a boiled icing containing one-half cup of chopped blanched almonds makes a delicious almond cake.

* * * *

Quick Coffee Cake.

Ingredients: *1 cup flour, ½ cup cornflour or maizena, ⅓ cup sugar, 2 scant teaspoonfuls baking powder, and ½ teaspoonful each of salt and ground cinnamon.*

Sift dry ingredients well together, then mix to a soft dough with about ½ cup milk stirred into a well-beaten egg. Add four tablespoonfuls of melted butter, spread in a shallow pan, sprinkle with sugar mixed with a little cinnamon, and bake in moderate oven.

* * * *

Doughnuts.

Ingredients: *¾ lb. flour, ½ lb. sugar, 1 teaspoonful cream of tartar, ½ teaspoonful soda, 2 eggs, 1¼ cups (small) of milk.*

Mix so that it will drop out of a spoon, but not flow. Fry in deep fat.

Rice Dumplings.

Take 1 lb. of rice, let it boil quite soft, then allow it to cool. Stir in ½ lb. of flour, a spoonful of butter, and 2 eggs. Make into dumplings with a spoon, and boil in hot water; dumplings will float to top when done. Serve with sugar, mixed with a little ground cinnamon and melted butter.

* * * *

Baking Powder.

Housewives will find it much more economical to make their own baking powder. The following are two recipes:—

I.

Ingredients: 1 lb. cream of tartar, ½ lb. bicarbonate of soda, ½ lb. cornflour or maizena.

Sift all these together four or five times, and put in tight tin cans. This will make two pounds.

II.

Sift together 1 lb. bicarbonate of soda, ¾ lb. tartaric acid, and 1 lb. ground rice. Put away in tins.

* * * *

Hints for Pickling.

1. Strong vinegar is essential.
2. Pickles should be kept well covered with vinegar.
3. Pickles are kept best, and in the most attractive condition, by bottling and sealing while hot.
4. Keep in a dry, cool, dark place; horse-radish and cloves are helps to their preservation.
5. Ginger is the most wholesome spice, and cloves the strongest.
6. If mildew appears on the vinegar, pour off, add a handful of sugar to each gallon, scald, skim, and pour back.

* * * *

Candied Orange Peel.

Let the peel (cut in quarters) soak for about a week in a weak brine made of 2 scant tablespoonfuls of salt to a quart of water. Put into cold water, boil, changing the water several times, using cold water each time, until soft enough to pierce with a straw. Drain thoroughly, and cut into strips. Make a syrup of 1 lb. of sugar to 1 lb. of fruit (one cupful of water to each pound of sugar), sufficient to cover the peels. Let peels boil till the syrup is nearly all absorbed; be careful not to let it scorch. Then roll in powdered sugar, and after drying in the sun, put away in glass jars. Do not let it dry too long, as it becomes hard.

III.—CONTRIBUTORS' COLUMN.

Readers are requested to send in their favourite recipes, and new suggestions, ideas, and contributions of any kind—pertaining to the house—will be gladly received. Address to:—Jeanette C. van Duyn, Department of Agriculture, Pretoria.

We desire to thank the contributors of the following recipes:—

Chocolate Cake.

Ingredients: 1 cup sugar, 3 eggs, 1½ cups flour, ¼ lb. butter, ¾ cup milk, 1 teaspoon baking powder, vanilla flavouring.

Beat butter and sugar to a cream, adding nearly all the milk by degrees; add eggs well beaten, then the flour, into which baking powder and a pinch of salt have been well mixed; lastly, the rest of the milk in which two dessertspoonfuls of cocoa have been dissolved. Bake in two flat tins for quarter of an hour in a fairly hot oven, then put in a layer of the following:—

Filling.

Ingredients: 1 *tablespoon butter*, 3 *tablespoons icing sugar*, 1 *teaspoon vanilla essence.*

Slightly warm the butter (which should be well washed to remove the salt), beat in the sugar and vanilla till it looks like thick cream. Before putting filling in let cake cool.—Mrs. J. A. Neser.

Lemon Mange.

Ingredients: *Juice of* 6 *lemons*, 2 *teacups water*, *sugar to taste*, 2 *tablespoons maizena*, 2 *eggs.*

Boil lemon juice, water, and sugar together, then stir in maizena mixed with a little water; boil well, remove from fire, and stir in briskly the beaten whites of eggs; then turn into mould. Make a custard of the yolks of eggs and pour over when cold.—Mrs. J. A. Neser.

An Excellent Way to Cook a Freshly-Killed Fowl.

What farmer's wife, living in a lonely district, does not know the many difficulties of preparing a nice dinner for an unexpected guest? Perhaps twelve miles from the nearest butcher, the sheep on the farm too few and precious to kill, and game out of season. Have you any fowls? Get your boy to catch, kill, and pluck a young rooster. Draw and truss as you would for roasting. Put into a deep pan 2 tablespoonfuls good dripping; put your fowl into the pan with a sprinkling of salt and pepper; cover tightly with the lid and put on the stove to cook. Turn the fowl over occasionally or it will stick to the bottom. A young chicken requires three-quarters of an hour—an older one one hour and a half, or till tender. The cooking is done in the steam of the fat, so it is most necessary to keep the lid of the pan firmly down.

A Gravy for the Fowl.

While the fowl is cooking put a tablespoonful of butter in a frying pan, let it get quite brown, then add a teaspoonful of flour, stir it into the butter till a rich colour, add a little hot water, pepper, salt, and a pinch of spice, boil two or three minutes till it thickens, and it will be ready to serve with fowl.—The Hon. Mrs. H. Scott.

A Cool Place for Butter or Milk.

Get from your grocer one big biscuit tin—the long, narrow kind with a hinged lid. Pierce two or three holes in it round the side. Lay it on its side in a clean sack—the door of the box to the mouth of the sack. Then on top of the safe put a paraffin tin full of water, make a minute hole in the tin and the water gradually soaks into the sack below. This safe keeps at least 10 degrees cooler than the outside temperature if placed on the stoep where a good

breeze blows on to it. It is as well to put the biscuit tin on a box to raise it off the ground. The paraffin tin will require filling every day.—The Hon. Mrs. H. Scott.

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A correspondent from Scotland has kindly contributed the following three recipes:—

SCOTCH DROP SCONES.

Ingredients: 2 teacupfuls flour, ½ teaspoonful bi-carbonate of soda, 2 teaspoonfuls sugar, 1 egg, and 1 teacupful buttermilk or sour milk.

Put dry ingredients into basin and mix well; make a well in centre of flour, break egg into it, add 1 teacupful of milk—just enough to make a thick batter—and beat for five minutes. Make griddle quite hot (or use top of stove), rub over with little butter or lard, and drop spoonfuls of the batter a little apart, keeping shape as round as possible. When half done slip a knife underneath, turn quickly, and brown on other side. Can be eaten hot or cold.

* * * *

SHORTBREAD.

Ingredients: 1 lb. flour, ½ lb. butter, ¼ lb. sugar, 1 eggspoonful baking powder.

Beat butter to a cream, work in flour and baking powder, and add sugar. Mix well, turn on to a board, knead well with hands, make into two round flat cakes, tap well with fork, and bake in slow oven.

* * * *

SHORTBREAD BISCUITS.

Ingredients: 6 ozs. flour, 2 ozs. ground rice, 4 ozs. butter, 2 ozs. sugar.

Knead on board, cut into little thin rounds, and bake in slow oven for twenty minutes.

* * * *

POTTED MEAT.

Ingredients: ½ lb. lean steak, ¼ lb. kidney, a rasher of bacon.

Cut in pieces, put in stew pan with one dessertspoonful of water. Let it cook until quite tender, then put through mincing machine several times. Season to taste, and put in dish to set.—Mrs. Stanley Eales.

* * * *

KISSES.

Ingredients: 2 eggs (¼ lb.), their weight in sugar, butter and flour, ½ teaspoonful carbonate of soda, 1 teaspoonful cream of tartar.

Mix butter and sugar, add eggs well beaten, then mix in other ingredients. Drop in spoonfuls on baking sheet, and bake in a quick oven for four minutes.—Mrs. Stanley Eales.

* * * *

HOME-MADE SOAP.

Take a tin of caustic soda (5 lbs.), add contents to twelve bottles of water; melt and strain 33 lbs. of any kind of fat or lard, and add the soda and water to fat when both are sufficiently cooled

down, stirring constantly till the mixture thickens well; then pour into a large wooden mould in which a calico cloth dipped in water has been spread, cover up the soap well, leave for two days, then cut out into bars. The small pieces which are left over when the soap is cut can be made into splendid scouring soap by adding a little fine ground white sand and boiling again; when cold cut into small cakes. (The Kaffir girls here grind the sand on large flat stones.)—Mrs. Dick Laffnie.

[*In sending the above recipe Mrs. Laffnie states that she has never yet had a failure; that it gets beautifully hard, and is easy to make, the most important part in the process being the continual stirring. Mrs. Laffnie kindly sent us a sample, and we can confidently recommend it to our readers.—J. C. v. D.*]

* * *

Mealie Meal Bread.

I.

Ingredients: 2 plates of flour or Boer meal, 2 plates mealie meal, ordinary leaven, and salt to taste.

Mix with warm water to the required consistency.

II.

Ingredients: 2 plates Boer meal and one of thin mealie meal porridge, leaven, salt, and warm water.

It is advisable to make this into a stiff paste. When baked the mealie meal will be scarcely perceptible.

III.

Ingredients: 2½ plates mealie meal, half a plate cold mashed potatoes, leaven, and salt to taste.

Mix with warm water. This bread rises almost like hop bread, and is very nice.—Mrs. Dick Laffnie.

Sweet Peach Pickles.

Ingredients: 10 lbs. peaches peeled and cut up, 1 heaping plate of small onions, or large ones cut in half, 2 lbs. sugar (or less, as preferred), 2½ to 3 bottles vinegar (grape vinegar is the best), 1½ tablespoonfuls curry powder, 1 teaspoonful salt, 2 tablespoonfuls mixed spices, viz., cloves, coriander, allspice, and ginger.

Strew the sugar and salt over the peaches, and leave over-night. Pour the syrup off the fruit next morning, and boil it with the vinegar and all the other ingredients. Bruise the spices and tie in a piece of muslin, then drop into the vinegar. When the onions are so soft that they can be pierced with a straw, drop in the peaches and just boil once as for canned fruit. They must be crisp, not too soft. Bottle hot, as canned fruit. If spices are wanted in the pickles, do not bruise them and leave them in the vinegar.—Mrs. M. Celliers.

* * * *

Sugar Sticks.

Ingredients: 1 lb. brown sugar, 1 lb. golden syrup, flavouring to taste.

Put into a pan on the fire, when it begins to boil time it, and in twenty minutes drop some into a glass of water. When it hardens

pour on to a buttered dish. When just cool enough to handle take half the quantity into your hands and keep pulling it out till it becomes a light yellow; then pull the other half into a string about half a yard long, and twist the two strings together. Now sprinkle some fine sugar on the board, and roll the sugar stick as long and thin as wanted with the hands, and with a pair of scissors snip into sugar sticks or bulls-eyes as preferred.—Mrs. M. CELLIERS.

* * * *

SOFT GINGER-BREAD.

Ingredients: ½ cup treacle (fill up the cup with sugar), ½ cup butter (fill cup up with boiling water), 2 cups flour, 1 teaspoon ginger, 1 teaspoon carbonate of soda.

Mix ingredients together and bake in quick oven.—Mrs. J. VAN DEN BERG.

* * * *

CORN CAKES (MEALIE MEAL).

Ingredients: Sift 3 cups mealie meal with 1 cup flour, ½ teaspoon salt, 3 tablespoonfuls sugar, 2 full teaspoons baking powder, 1 tablespoonful butter (after it has been melted over the fire), 3 cups sweet milk, 1 egg (without beating).

Mix meal, flour, sugar, salt, and baking powder together in a basin, then mix with milk, adding egg and melted butter last. Beat all well and bake thirty-five minutes in a moderately hot oven in either patty tins or cake pans—only fill the tins half full. Very suitable for breakfast; to be eaten with jam or butter.—Mrs. J. VAN DEN BERG.

* * * *

A correspondent from Cyterbult, District Krugersdorp, kindly sent the following recipe:—

COCOANUT FINGERS.

Ingredients: 4 ozs. castor sugar, 4 ozs. butter, 2 eggs, 1 teaspoonful baking powder, 6 ozs. cornflour, 3 ozs. desiccated cocoanut, and a little milk.

Rub butter and flour together until very fine, add corn flour, baking powder, sugar, and 2 ozs. of the cocoanut. Mix thoroughly, beat up eggs and add them, work into a smooth dough (if paste is too thick add a little milk). Roll out about ¼ inch thick; cut to shape. Place on buttered baking sheets, brush over with a little sweetened milk and egg, sprinkle rest of cocoanut on top, and bake about fifteen minutes in a moderate oven.

IV.—HOUSEHOLD SCIENCE NOTES.

Secret of Light Batters.—When making Yorkshire puddings, pancakes, and fritters, prepare them several hours before they are wanted, as this gives the flour a chance to swell, and renders the batter much lighter.

To make Boots wear well.—Varnish the soles; it will make them waterproof and they will wear longer.

When washing Pongee silk never wring it at all: simply hang it on the line and let the water run down. Iron with a warm iron when dry and it will look equal to new.

When ironing collars place a small round cake tin in the oven and put the collars in as you iron them. This keeps them in a round shape, and they also stiffen better through being put in a warm place. Keep the oven door open so that it does not get too hot, and only leave them in for a few minutes.

The following suet hint will be found very useful and much quicker than the old way: Grate the suet instead of chopping it, or put through the mincing machine with a little flour; it will fall into nice light flakes without lumps.

If glacé silk hats get dusty they should be rubbed with a piece of velvet and they will look like new again. A brush should not be used as it rubs the dust in.

Never put salt into soup when cooking until it is skimmed, as salt prevents the scum from rising.

When making toffee mix with the ingredients as much cream of tartar as will lie on a sixpence. This makes it crisp like bought toffee and prevents it from sticking to the teeth, which is generally the failing of home-made toffee.

To revive black straw hats milk and soot rubbed on have a good effect.

Never scrape a burned baking dish, put in a little ashes or washing soda, fill with cold water, put on fire and bring to boil.

The Royal Society of Arts (London) offered a prize for the best process of cleansing silk, woollens, and cotton fabrics—one that would not change their colour nor injure them in any way. The winning recipe was as follows: Grate two good-sized potatoes into a pint of clear, clean soft water. Strain through a coarse sieve into a gallon of water and let the liquid settle. Pour the starchy fluid from the sediment and it is ready for use. Rub the articles gently in the liquid, rinse thoroughly in clear water, dry, and press.

Washing Tussore Silk.—Wash in tepid soap suds, rinse in tepid water. Let the articles get quite dry; do not sprinkle. Iron dry on the right side with a hot iron. Be careful not to scorch. If wanted stiffer rinse in sugar-water, or water in which a little borax has been dissolved, and hang up to dry.—Mrs. M. Celliers.

For stiffening moreen under-skirts after washing dip them into strong glue-water instead of starch. Iron whilst damp.—Mrs. M. Celliers.

To get a pretty shade of ecru for white curtains add some powdered yellow ochre (the kind painters use) to the starch.—Mrs. M. Celliers.

To test whether your cake or bread is quite done hold your ear down to the pan and if you hear a slight cracking sound as of small bubbles, it should stay in the oven a few minutes longer. It is not quite dry.—Mrs. M. Celliers.

* * * *

How to Remove Stains.

All stains should be removed before the articles are put in the washtub. The sooner a stain is treated the more readily it will yield to the treatment. Pour boiling water through fruit stains; when obstinate soak in a solution of oxalic acid. Wash vaseline stains in alcohol; paint in turpentine or alcohol; varnish in alcohol; grass or other green vegetable stains in alcohol, paraffin, or molasses; for

stains from blood or meat juice use white of egg in cold water. In the case of milk, cream, sugar, or syrup stains soak in cold water and wash with soap and cold water. Tar, wheel grease, or machine oil stains should be rubbed with lard and allowed to stand a few minutes; then they should be washed with soap and cold water. Tea, coffee, or cocoa stains should be removed with boiling water; if obstinate, with a weak solution of oxalic acid.—(*Ladies' Home Journal.*)

Spots on margins of engravings can be removed by a solution of hydrochloride of soda.

Peach stains will readily yield to a treatment with spirits of camphor. Soak the stain for a while in the camphor and then wash it in water.

Iron rust and black ink stains can be removed from linen by a warm solution of oxalic acid or diluted muriatic acid, then rasped tin.

* * * *

Waterglass for Preserving Eggs.

Waterglass is the name given to a solution of silicate of soda, and is prepared by dissolving the chemical in water. It is now largely sold in the form of a concentrated solution, to which should be added five or ten times its bulk of pure hot water, according to the strength. The preparation should be quite cold before it is used. Experiments in America have shown that a three per cent. solution (i.e. three parts of waterglass to ninety-seven parts of water) yields as good results as that generally recommended, namely, ten per cent. When the waterglass is added to the water the two must be very carefully and thoroughly mixed. The eggs may be dipped in the waterglass anu dried off, leaving a film on the shell, and then stored upon shelves, or they may be kept in the liquid until solid or used; the latter method is to be preferred. When taken out of the solution they are sticky, and before packing should be wiped and dried off.

Recent tests conducted by private persons in Pretoria have given excellent results, the eggs being seemingly as fresh when taken out as when put in. Waterglass can be obtained from any chemist.

Useful Facts and Figures for Farmers.

SUGGESTED STANDARD POINTS FOR AN AFRICANDER BULL.

(Transvaal Stock Breeders' Association.)

1. Colour, blood-red.
2. Head and neck—
   (*a*) Forehead, broad.
   (*b*) Face, comparatively long and lean.
   (*c*) Eyes, large, full, expressive, indicative of good disposition.
   (*d*) Muzzle, clean cut, nostrils large.
   (*e*) Horns, long, low set, slightly elevated at tips, waxing at base, amber tipped.
   (*f*) Neck, thick, short, with well-defined hump, throat full, with loose flesh underneath.
3. Forequarters—
   (*a*) Shoulder, heavy, broad, well covered on blades and top.
   (*b*) Brisket, deep and projecting prominently from between the fore legs.
   (*c*) Dewlap, commencing abruptly, drooping and fairly loose.
   (*d*) Legs, straight, short, especially under knee, arm full, shanks fine.
4. Body—
   (*a*) Chest, deep and full at the back of elbows.
   (*b*) Barrel, large and deep, with fairly well developed abdomen. Ribs fairly well sprung. Back fairly straight.
5. Hindquarters—
   (*a*) Hips, not prominent, moderate in width.
   (*b*) Rump, drooping.
   (*c*) Thighs, broad, but thin and rounded.
   (*d*) Legs, short, shank fine.
   (*e*) Tail, low set, thin, and with good switch.
6. Skin—
   Soft, elastic, and of medium thickness.
7. Hoofs—

Colour dark amber, pointed, and toes close together. Medium sized feet, that will stand wear.

SUGGESTED STANDARD POINTS FOR AN AFRICANDER COW.

1. Colour, blood-red.
2. Head and neck—
   (*a*) Forehead, broad.
   (*b*) Face, comparatively long and lean.
   (*c*) Eyes, large, full, expression indicative of good disposition.
   (*d*) Muzzle, clean cut, nostrils large.
   (*e*) Horns, long and thin, low set, slightly elevated at tips, light amber at base, darkening towards tips.
   (*f*) Neck, fine, neatly joined to head and shoulders, not quite free from dewlap.

3. Forequarters—
   (a) Shoulder, close to the body, oblique, slightly higher than hindquarters.
   (b) Brisket, deep and well developed.
   (c) Dewlap, drooping, fairly loose, and commencing abruptly.
   (d) Legs, straight, short, especially under knee, arm full, shanks fine.
4. Body—
   (a) Chest, deep and fairly broad.
   (b) Barrel, large and deep, with fairly well developed abdomen. Ribs fairly well sprung. Back fairly straight.
5. Hindquarters—
   (a) Hip, slightly prominent, moderate in width.
   (b) Rump, drooping.
   (c) Thighs, broad but thin.
   (d) Legs, short, shank fine.
   (e) Tail, low set, thin, and with good switch.
6. Skin—
   Soft, medium thickness, and elastic.
7. Hoofs—
   Pointed, dark amber. Toes close together.

SELECTION OF STOCK.

("Elements of Agriculture"—Fream.)

Whilst, in the improvement of stock of all kinds, the breeder should exercise his powers of selection both on the male and on the female side, there is a reason for special trouble being taken in the selection of the sire. This is, that the sire is usually the parent of many offspring, whilst the dam—in the case of the mare, the cow, and the ewe—only gives birth to one or two young in the course of a year. Hence the pedigree, that is the line of descent, of the sire is of special interest and importance.

A breeder often begins operations with a very indifferent herd of cattle, or a decidedly inferior flock of sheep. But by the use of pure-bred sires the prepotency of the latter has its effect, and the offspring will probably resemble the sires rather than the dams. Pure-bred sires are again mated with the female offspring, and, by the continuation of this course for some years it is possible to so improve the herd or flock that at length it comes to be recognised as "pure-bred."

WHAT TO LOOK FOR IN A BROOD SOW.

(*Journal of Agriculture*, Western Australia.)

It is not such a difficult thing as might be expected to go into a piggery with a large number of the usual cross-bred and mongrel sows, and pick out the sows which produce the best litters. Milk production and general maternal capacity are associated with certain characteristics in pigs as in dairy cattle, and a little study of type in pigs will enable any one to pick out the most profitable sows to use for breeding purposes. Before indicating what to look for it might be as well to state that there should be no second look at the pretty little sow. She is a charming picturesque animal, round and beefy, small points, and fine bone, just the sort of pig

to make a carcase butcher glad, and such is her best destination. In the breeding pen her litters will be small, her milk secretion will be light, and her progeny will not develop with the intensity of vigour which is the best thing to drive pigs to a profitable death. The refined Berkshire is a good illustration of this type, and should be avoided in the breeding pens. It will be found that in most instances the sow which is the very antithesis of this is the best parent. Her body is long, deep, and comparatively narrow. It should be remembered that the digestive organs of the brood sow play, perhaps, the most important part in her career. They are called upon to do more work at certain times than the digestive organs of any other animal, and the success of her litters is largely determined by the amount of food which they can make ready for conversion into milk. Hence it is that length and depth in the body are exceedingly important features in a sow for breeding purposes. The next thing to look for is a well-formed udder, free from badly-developed patches or calloused parts. The phlegmatic sleepy sow is to be avoided. Good mothers are generally somewhat nervous, like dairy cows. Milk secretion has been proved to be largely a nervous function, and the dull, somnolent sow is seldom a mother of high order. A good backline is a useful point. Hollowed backs are not safe ; they should at least be level, and, if slightly arched, so much the better.

Many, when choosing sows, avoid those coarse in their points, but this is a mistake, for the type of sow referred to is generally somewhat coarse about the head and long about the legs. The latter point is a good one, for, unless such a sow had longish legs it would be found that as she approached farrowing time her udder would become chafed and sore from contact with the ground. The best brood sows will generally be found to be "clean" in the jowl and shoulder, their head, neck, and shoulder suggesting those of the Jersey cow. It is thus seen that the sows recommended for breeding purposes are not the least like the animal which they are required to produce for the butcher ; indeed, they may be said to be the opposite type. Consequently, the boar should be a good specimen of the meaty type, like the Berkshire. It will be found that the offspring take after the sire largely in external form, and the vigour, constitutional strength, and digestive capacity of the mother will be inherited to the resultant benefit of the breeder.

PROPORTION OF LIVE TO DEAD WEIGHT OF STOCK.

("The Agricultural Valuer's Assistant"—Bright.)

Well-bred and maturely fattened oxen, sheep, and calves yield from 57 to 60 per cent. in carcase to fasted live weight. Exceptionally fat oxen or sheep may yield from 64 to 68 per cent.

Generally speaking, ordinarily fattened oxen, calves, and sheep yield 8 lbs. (butchers' stone) of dead weight for every 14 lbs. (imperial stone) of fasting live weight.

Moderately fat pigs killed for fresh pork, including head and feet, should yield about 80 to 82 per cent. of live weight ; large, well-fattened pigs sometimes yield as much as 86 per cent.

Although the weigh-bridge offers many advantages to the agriculturist in assisting him to determine the weight of fat stock, yet the proportion of live to dead weight will, in a large measure, depend on the condition of the animal, and such condition will still remain a matter of judgment.

DENTITION AND AGE OF CATTLE.

("Handbook of Agriculture"—Prof. F. Blersch.)

The ox has thirty-two teeth; these are divided into twenty-four molars, six on each side of the upper and lower jaw respectively, and eight incisors in the lower jaw. It has no canines, and no incisors in the upper jaw. The dental formula for cattle is therefore this:—Incisors 0/8, canines 0/0, molars 6/6, 6/6, or a total of thirty-two teeth.

The new-born calf generally has two central temporary incisors, either only protruding through the gums or fully out. At the expiration of the third or fourth week the animal will have the full number of temporary incisors, viz., eight. The milk teeth soon wear down somewhat and also diminish in size, a kind of absorption taking place, so that the spaces between them increase considerably. This wearing down and diminution of the temporary incisors will proceed till the permanent teeth appear. The first change generally takes place at the age of eighteen months or two years, when the two central permanent incisors appear: in every succeeding year the animal gets two more permanent teeth, so that at the age of four to five years it is full-mouthed. The process of wearing down and absorption of the teeth takes place in the full-mouthed animal in a way similar to that described in the milk-teeth period, so that from the state of the teeth the age may, to some extent, be guessed. Dentition is by no means regular, and depends greatly on the keeping and feeding of animals: thus the development is slower in badly cared for and badly nourished animals: and the wearing down of the teeth is faster in beasts running on short and gritty pasture.

The age of cattle is also sometimes told by the number of rings or wrinkles at the base of the horns. When the animals are three years old they show the first ring, and a fresh one is added every year. The appearance of four distinct rings, therefore, would indicate that the age of an animal is presumably six years. These rings, however, are not entirely reliable signs for judging the age, and as we advance beyond seven or eight years, cannot serve for determining the age at all.

MEASURING LUCERNE HAY.

(*Pacific Rural Press.*)

A statement by Prof. A. M. Ten Eyck in the *Kansas Farmer*, describing practice in that State, may be of interest.

An average bale of alfalfa hay, sold on the market at Manhattan, weighs about 85 lbs., the average length of the bale is about 40 inches, and the other dimensions are 15 by 20 inches, making the total volume of a bale about 7 cubic feet. Twenty-three and one-half bales will make a ton, figuring 85 lbs. per bale and 164.5 cubic feet of space will be required to store these 23½ bales, that is, figuring actual volume; doubtless, we should add 10 per cent. more space for room lost between bales in storing, making about 180 cubic feet of space required for storing a ton of baled alfalfa hay. Ordinarily, 512 cubic feet is figured as the volume of a ton of hay in the mow or stack soon after stacking, or about the time hay is well settled. The volume of a ton of baled hay is, therefore, equal to about one-third the volume of a ton of loose hay in the stack or mow. If the total space in the barn holding twenty-five tons of loose hay could be used for storing the baled hay the barn would hold in the neighbourhood of seventy-five tons of baled hay.

TO PREVENT BIRDS PULLING UP YOUNG MAIZE PLANTS.

("Handbook of Agriculture"—Blersch.)

To prevent birds from pulling up the young maize plants, the seed may be coated with coal-tar or Stockholm tar. For this purpose the maize grain should be soaked in water previous to treating with tar, since the coating might prevent the seed from absorbing the necessary moisture for germinating. The tar is stirred into the grain, or vice versa, and about one pint coal tar, or half as much boiling Stockholm tar, is required for one to two bushels of maize. Before the planting, the seed is rolled in dry earth or ashes to prevent it from sticking to the mealie planter.

TO TREAT INSECTS IN STORED GRAIN.

(*Journal of Agriculture*, Western Australia.)

Any one troubled with insects in grain stored in bins or "shot" in the granary, may successfully deal with their extermination in a very simple way, as Prof. Ewart, of the Mississippi Experiment Station, has shown. This is done by sprinkling bisulphide of carbon. It kills by means of its fumes, and, being liquid, and heavier than air, is easily manipulated. Simply sprinkle sufficient bisulphide on the top of the grain and the fumes sink through to the bottom. This has been used at the rate of one ounce of bisulphide to the hundred pounds of grain, or a pound to the ton; but experience has shown that a much smaller quantity will do the work.

[As carbon-bisulphide is highly explosive, care must be taken not to approach it with a lighted pipe, candle, etc.—Ed.]

PREVENTION OF WHEAT AND BARLEY SMUT.

(*Journal of Agriculture*, Western Australia.)

The use of copper-sulphate (bluestone) has been known for many years. It consists in immersing the seed for one or two minutes in a solution prepared by dissolving 1 lb. of commercial copper-sulphate in five gallons of water and then putting the seed for five or ten minutes in lime water made by slaking 1 lb. of lime in ten gallons of water. This treatment is cheap, easily applied, and very effective. The treatment of seed with various strengths of formalin has of late years been the subject of much experimental investigation, and it has been found very valuable for the prevention of various smuts. It is recommended to be used at the rate of one lb. to fifty gallons of water. The seed should be soaked in the solution for about ten minutes, care being taken to keep the grain well stirrred so as to increase the thoroughness of the application.

STRAW BUTTER BOXES.

(*The Agricultural Gazette*, London.)

In future the boxes containing butter shipped from Queensland to Great Britain are to be made of straw, and a £50,000 company has been formed to work the business. Butter boxes have hitherto been made of pine, but the drain upon this timber owing to the heavy exports has been so severe that the wood is rapidly going up in price. One can understand this on noting that in one month (March, 1908) over 50,000 boxes of butter

arrived from Queensland in this country; 1,250 tons, worth £140,000. The new box is made of barley straw. In its manufacture a mixture of kaolin and straw is used. It can be produced and sold for 1s. At present 3,000,000 boxes are used in Australia annually, costing £200,000. The new boxes will save the dairy industry about £40,000 a year. The material for manufacturing the box can be grown in the same paddock that supports the cow. The new type of box is in every respect equal to the old. It weighs about 10½ lbs., is damp proof, and odourless.

DISTANCES TRAVELLED IN PLOUGHING.

Showing the distance travelled by a horse in ploughing an acre of land:

Breadth of Furrow Slice. Inches	Distance travelled in ploughing an Acre. Miles
7	14½
8	12½
9	11
10	9 9/10
11	9
12	8¼
13	7½
14	7
15	6½
16	6⅙
17	5¾
18	5½
19	5¼
20	4 9/10

Extracts from Exchanges.

SHARE-FARMING.

(*Journal of Agriculture,* Western Australia.)

A considerable number of farms in New South Wales, and particularly large ones, are worked on the "shares" system, which is described in the following manner in the June *Agricultural Gazette* of New South Wales :—

Under this system a farmer possessing the necessary team and implements arranges with the landowner to crop a certain area for a season or for a number of seasons. The usual form of agreement provides that the landowner shall provide land, seed, two-thirds of the manure (where manure is used), and bags for his share ; the farmer on his part must perform all the operations of cultivation and harvesting in a workmanlike manner, and at seasonable times, using his own plant for the purpose ; he must also provide one-third of the manure (where manure is used), and bags for his share. Up to a specified yield of crop, the owner and farmer take equal shares ; any excess becomes the property of the farmer as a bonus to encourage good and thorough farming. Special arrangements are often made to suit local conditions. This method of working large areas is invariably a success where the arrangement is drawn up on a truly co-operative basis, and is one of the most satisfactory ways of working large estates. At Iandra, the birth-place of this system in New South Wales, some 18,000 acres are planted on the share system. Share-farming is admittedly not so desirable a condition as that in which every man farms his own land, but such a system is one by which a man who has no land of his own may accumulate enough means to buy some. That it has done this is proved by the cases of farmers who now have comfortable properties of their own, but who commenced as share-farmers. To reputable, suitable men without capital or plant some landowners have advanced sufficient capital to enable the men to buy plant and make a start. In some cases the owner places a price on the land, and gives the share-farmer the option of purchasing his area at that price after five years.

* * * *

RAMIE IN RHODESIA.

Of all parts of South Africa probably the climate of Rhodesia is best suited to ramie cultivation. We are interested, therefore, in noting the following comments on the subject of ramie in the last issue of the *Rhodesian Agricultural Journal,* from which we take the liberty of quoting verbatim :—

The high value of the finished ramie fibre (filasse) is indisputable, being one of the strongest and most durable products on the market. It can be used for the manufacture of articles varying from bank notes and underwear to tarpaulins and cables. It is easily grown, prolific, and perennial, and said to command a price of £30 to £40 per ton on the Home market. Why, then, is not this wonderful plant universally grown in the colonies, and its fibre universally employed by the Home manufacturers ? And why must our advice to prospective planters be a word of caution ? It is not because of the inherent defects of the fibre itself, though it is far from perfect. "It lacks the elasticity of wool and silk and the flexibility of cotton. As a result it yields a harsher fabric, which has not the softness of cotton. Owing to its smooth and regular surface it is difficult to

spin to fine counts, as the fibres lack cohesion and will not adhere to each other." (*Matthews.*) It is also a very exhausting crop, taking large quantities of potash and phosphoric acid from the soil. But the combination of all these drawbacks is not in itself sufficient cause for our saying, as we do say: Put no capital into ramie growing until it has been *proved profitable.* Here is the crux of the matter; as we may buy even gold too dear, so also the production of ramie ribbons may be, and is, too costly. This has nothing to do with the cultivation of the plants, which are easily grown here, and samples from Rhodesia have been favourably reported upon. The difficulty lies in the expense of preparing the fibre for export in such a manner as to be acceptable to the manufacturer, and in sufficient quantities to be profitable to the planter.

What is wanted is a cheap machine that will strip the ribbons (decorticate) cleanly and rapidly. More than one machine has been invented that will do the work well enough, but so far as our present information goes none of them can be relied upon to turn out the ribbons fast enough. "The ribbons must be susceptible of being delivered to the degumming factories (in Europe) at a cost not exceeding £7 to £9 per ton." It has been estimated that this cannot be done with any machine turning out less than half a ton of ribbons per day at a small cost. It may be that such a machine exists, but up to date we have failed to get hold of a prospectus of it. The yield of clean ribbons (not degummed) is usually estimated not to exceed half a ton per acre when three cuttings per year are made.

It is evident, therefore, that while finished ramie filasse is worth anything from £30 per ton upwards on the European market, the cultivation of the plant and the export of the ribbons is far from being the profitable undertaking it is often represented to be. We advise our local farmers to be very cautious, and not to put money into ramie till the existence of a cheap and effective machine has been finally demonstrated.

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RAMIE IN CALIFORNIA.

(*Pacific Rural Press.*)

I have a letter from a friend desiring some information about ramie, or a fibre resembling it. About what does it cost to produce it? About how much should be allowed for moisture and shrinkage from the green to processed state? Is there a machine on the market that would strip the stuff from the sticks?—Enquirer, San Francisco.

Ramie growing has been undertaken spasmodically in different parts of California for the last thirty years, and thus far no commercial product has been attained. The plant will grow both in coast and interior situations very freely, the length of stalk being, however, conditioned upon the presence of moisture. On the rich, moist, low lands of Kern County ramie stalks have grown to a height of 15 feet or more. The reason why, in spite of this splendid adaptation of California conditions to the growth of the plant, there is no commercial product, is because no ramie machinery or processing has yet demonstrated capacity enough to allow successful competition with the cheap labour in Asiatic countries, whence the fibre is now derived. There is no difficulty about producing a fine sample of ramie fibre, but the economic question of producing it cheaply enough has not yet been solved, although scores of people have thrown away time and money in vain efforts to demonstrate profit in their appliances and processes.

RAMIE IN INDIA.

(B. Coventry, in *The Agricultural Journal of India.*)

There is still much room for improvement in the Faure machine, but this is only a matter of time. The real difficulty about rhea is its agricultural aspect. Is it possible to obtain one ton of dry fibre from three acres per annum? This is the vital question at the present price and with the present machine, for after all the ultimate test as to whether it pays to grow depends upon the profit *per acre.* The more acres it takes to produce a ton of fibre, the less must the profit be, and inversely the heavier the crop which can be grown, the larger the profits. Now the agricultural requirements of rhea (or ramie) do not seem to have been thoroughly appreciated. It is not a plant that will grow anywhere. It requires well-drained land, and that of the best quality. It must be well cultivated, and until the refuse from decortication has accumulated in sufficient quantities in a well-rotted condition, other manures must be applied to it and, if necessary, purchased. Too dry a climate will not suit it, for to obtain four full cuttings in one year postulates a considerable amount of humidity. After a time the roots will have covered the field and an accumulation of wood will have taken place from repeated cuttings. It will then be necessary to prune the surface of the stool to induce shooting from the root. Should this eventually prove unsuccessful, and the plant refuse to grow to a greater height than three to four feet, it should be dug out and a fresh plantation started in another spot. It is a mistake to suppose that rhea will grow on the same land indefinitely. Rotation is as necessary for this crop as for any other, the time for the change being determined as I have indicated.

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THE AMERICAN MAIZE CROP OF 1907.

(*The Agricultural News*, West Indies.)

The final official estimate of the American maize crop of 1907 is 2,592,320,000 bushels. Although this is fully 335,000,000 bushels less than the yield of 1906, which formed a record crop, it has been exceeded only in that year and in 1905. There is consequently an ample quantity for export, and the amount shipped will probably be quite as great as would be the case if the crop were considerably larger. This is due to the fact that, with a record crop, prices tend to drop, and the growers prefer to feed the corn to stock instead of selling. At present prices, however, it would be more profitable to place on the market. As a rule, about one-thirtieth part of the maize crop of the United States is exported.

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POSSIBILITY OF DOUBLING THE PRESENT AMERICAN YIELD OF MAIZE.

(C. P. Hartley, in U.S. Department of Agriculture Farmers' Bulletin 199.)

It is possible within a few years to double the average production of maize per acre in the United States, and to accomplish it without any increase in work or expense. It is not to be understood from this statement that it is desirable to double the present maize crop, but that it is desirable to produce the same yield on a smaller number of acres and with labour. If 60 bushels (a bushel of maize on the ear is calculated at bs. weight) are raised on one acre instead of on two acres, the labour loughing, harrowing, planting, cultivating, and harvesting is greatly

reduced. The demand controls the quantity that should be grown. To meet demands the producers of the United States have, during the ten years previous to 1904, averaged in round numbers 2,000,000,000 bushels of maize yearly. In producing this amount a little more than 82,000,000 acres have yearly been devoted to maize growing. The average production per acre has been 24.2 bushels. Very few farmers would like to acknowledge that their average production for the past ten years has been less than twenty-five bushels per acre, but from the best estimates that have been made the conclusion is unavoidable that half of those who grow maize, harvest less than 25 bushels per acre. Twice this quantity is a fair crop, three times twenty-five bushels is a good crop, and four times twenty-five bushels per acre are frequently produced.

The lines of improvement that will most easily and quickly double the present production per acre are as follows:—(1) Improvement in the quality of seed planted, (2) improvement in the condition of the soil, (3) improvement in methods of cultivation.

AMERICAN MAIZE GRADES.

(Bulletin of the Imperial Institute, Volume VI, No. 3, 1908.)

The rules recommended by the Chief Grain Inspectors' National Association of the United States of America classify maize-grain into three classes, viz.:—Yellow corn, white corn, and mixed corn. The following are the rules:—

No. 1 yellow corn shall be pure yellow corn, sound, plump, dry, sweet, and reasonably clean.

No. 2 yellow corn shall be 95 per cent. yellow corn, dry, sweet, and reasonably clean, but not sufficiently sound or plump for No. 1 yellow.

No. 3 yellow corn shall be 95 per cent. yellow corn, reasonably dry, reasonably clean, but not sufficiently sound or plump for No. 2 yellow.

No. 4 yellow corn shall be 95 per cent. yellow corn, not fit for a higher grade in consequence of being of poor quality, damp, musty, or dirty.

No grade yellow corn. (See general rule.)

No. 1 mixed corn shall be mixed corn, sound, plump, dry, sweet, and clean.

No. 2 mixed corn shall be mixed corn, dry, sweet, and reasonably clean, but not sufficiently sound and plump for No. 1 mixed.

No. 3 mixed corn shall be mixed corn, reasonably dry, reasonably clean, but not sufficiently sound and dry for No. 2 mixed.

No. 4 mixed corn shall be mixed corn, not fit for a higher grade in consequence of being of poor quality, damp, musty, or dirty.

No grade mixed corn. (See general rule.)

No. 1 white corn shall be pure white corn, sound, dry, plump, sweet, and clean.

No. 2 white corn shall be 98 per cent. white corn, dry, sweet, reasonably clean, but not sufficiently sound and plump for No. 1 white.

No. 3 white corn shall be 98 per cent. white corn, reasonably dry, reasonably clean, but not sufficiently sound and dry for No. 2 white.

No. 4 white corn shall be 98 per cent. white corn, not fit for a higher grade in consequence of being of poor quality, damp, musty, or dirty.

No grade white corn. (See general rule.)

No grade—General rule.—All grain of any kind and variety that is wet, hot, or in a heating condition, burned or smoky, contains weevil, or is for any reason unfit for warehousing, shall be classed and graded "No grade."

These rules have met with some criticism on the grounds that the terms give great latitude for individual variations of opinion; "reasonably dry" and "reasonably clean," for instance, being quite indefinite, and it has been suggested that the judgment of the inspectors should be guided and checked by actual scientific determinations of the percentages of moisture, of coloured grains, of damaged grains, and of broken grains, and dirt; though, of course, this could not be done with every consignment, but only with a certain number of selected samples with a view to keeping the standard of grading uniform.

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STORING GREEN SEED POTATOES.

(*The Agricultural Gazette*, London.)

An important point brought out in potato trials of recent years is the superiority of green, or immature, seed tubers over ripened ones. Not only have green sets been shown to produce the heaviest yields, but they have the additional advantage that they can be lifted before the crop is attacked by disease, or at any rate before it has a chance to go further than the foliage. Thus we get seed potatoes free from latent disease, and so at least make a clean start with the new crop. It is also found that the immature tubers make a faster and more vigorous start when planted in the spring, which leads to earlier yields. In order to save the seed tubers immature the crop must be lifted whilst the tops are still green, and, if possible, before they become touched with disease. Should any disease appear, the tops may be cut off and removed at the first sign of it, and the tubers lifted shortly afterwards ought then to be sound for storing. At one time it was thought that potatoes must be mature before they would store successfully, but now it is known that they may be kept quite well through the winter, even when the skins are quite tender and easily damaged, so long as they are not put into a pit or clamp in the ordinary way. If this is done they are sure to rot badly. To save them in perfection they should be allowed to lie on the ground exposed to the light for a few days, to green somewhat, and then be placed directly into the sprouting boxes, which must stand in a building into which light and air can be admitted, but which can also be made frost-proof. There is one other method of storing them, recommended as quite successful by Mr. M. G. Wallace, of Dumfries, a well-known authority on potato-growing, and one of the first to advocate immature seed. The potatoes are put into shallow clamps not more than two feet wide at the base, and covered or thatched with straightened straw only, without so much as a spadeful of earth to keep the straw in place. The straw is secured as in thatching a stack, and must be of good thickness to exclude frost. A layer of earth over the straw, as in the ordinary potato clamp, would be fatal to the keeping of green potatoes. In late districts, such as some of the potato-growing localities in Scotland, the potato crop seldom has a chance to mature before frost cuts off the foliage, and it has been suggested that this is the reason why Scottish seed potatoes give heavier yields than English. The first earlier growers of Ayrshire recognise this fact, and raise a large proportion of their early crops from tubers lifted while still quite soft and green. [It should be borne in mind that different climatic conditions may render this treatment inapplicable in some cases.—Ed.]

SOIL INOCULATION.

(*The Field*, the Country Gentlemen's Newspaper.)

Nitro-bacterine has at last been subjected to a test, the outcome of which is not likely to be objected to by any one desirous of getting at the truth with regard to this much-advertised nostrum. The Royal Horticultural Society obtained in March last from Professor Bottomley a supply of his soil-inoculating material, and applied it in their garden at Wisley to an experimental culture of peas. The soil at Wisley is described as a naturally poor, hungry one, but half of the experiment was tried on soil that had been cropped with celery the previous year. Each half was divided into twelve equal plots, each measuring 36 feet by 15 feet, the plots being separated from one another by paths a foot wide. The soil in some of the plots was inoculated as directed by Professor Bottomley, others were manured with dung, others received a dressing of lime; others with superphosphate and kainit, and others with calcium cyanide, which contains both lime and nitrogen. Four rows of peas were sown on each plot. Half of the seeds were inoculated, the other half were not. The total length of the rows of peas in the trial was over a quarter of a mile. Peas and beans have not as a rule produced high yields at Wisley, and neither had been grown for some years on the site where the experiment was made. All the conditions were therefore favourable for a thorough test of the manurial value of nitro-bacterine.

The results of this interesting experiment are recorded in the Journal of the Royal Horticultural Society, vol. xxxiv, part 2 (November, 1908), by Mr. F. J. Chittenden, F.L.S., who conducted the operations from start to finish. The peas used were Ne Plus Ultra, Duke of Albany, Telegraph, and Maincrop. They were sown on 10th March, and they germinated very regularly. The produce of each of the ninety-six plots was picked separately when the pods were of marketable size and carefully weighed, the total weight of the crop when shelled being 7½ cwt.

Mr. Chittenden gives particulars of the crops obtained from the various plots, and shows the differences, which in some cases are surprisingly in favour of non-inoculation, between the yield by the various manures as compared with that of nitro-bacterine. The totals are: Weight of peas from inoculated seeds, 450 lb.; weight of peas from non-inoculated seeds, 515 lb.; a difference in favour of non-inoculation amounting to 14 per cent. Nor had nitro-bacterine any influence on the earliness of the crop. It is noteworthy that similar results to those here recorded have been obtained by others who have experimented with nitro-bacterine this year. We were recently informed at Kew that experiments made there proved that this preparation had no effect whatever on the growth of various plants, leguminous and non-leguminous, for which it had been tried. There may, of course, be some other means than that devised by Mr. Bottomley for enabling plants to utilise the enormous supply of nitrogen from the atmosphere, but there can be little doubt now that the nodule-producing bacillus, *Pseudomonas radicicola*, is not amenable to artificial treatment that will make it in any sense a substitute for manures.

[Although the above shows that nitro-bacterine has failed in this case, one or two experiments, at least, have shown that the inoculation method has had favourable results.—Ed.]

Correspondence.

This column will be devoted to correspondence, and an endeavour made to reply to all enquiries upon agricultural topics of general interest, or concerning any of the articles published from time to time in the *Journal*.

Correspondents will kindly write on one side of the paper only. No manuscript will be returned.

All letters must be addressed to the Editor of the *Agricultural Journal*, Department of Agriculture, Pretoria.

MAAS.

With reference to an article on the above subject by Mr. Samuel Evans, Johannesburg, appearing in the January, 1909, issue of the *Journal*, he does not say which is the best form of sour milk as a preventive of disease, and which is most valuable as a food and how it should be made.—R. H. Orr, Johannesburg.

With reference to the request of your correspondent, Mr. Orr, I have to state: Most of the chemists in Johannesburg sell powders or tablets for the preparation of sour milk as recommended by Professor Metchnikoff. These powders or tablets are accompanied by detailed instructions as to how they are to be used. They are called different names by different manufacturers, such as lactobacilline, fermenlactyl, sauerin powders, etc. The other two points raised by Mr. Orr are answered very fully in an article entitled "The Milk Cure," which appeared on page 8 of the *Rand Daily Mail* of the 30th January, 1909.—Samuel Evans, Johannesburg.

With reference to the letter from Mr. Samuel Evans, appearing in the January, 1909, number of the *Journal*, on the above subject, in this neighbourhood "Maas" is simply the native (Sesutu) word for milk. Thick, or sour milk is called "Maasana." I do not think the natives employ any process for souring the milk beyond keeping it in not over-clean vessels. I do not know whether it has any effect on infant mortality, but this mortality is extremely high. Thick milk is, of course, an excellent and digestible food, and is much used on farms, but it could not replace tinned milk, for instance, with tea or coffee or in cooking. The reason that sour milk is supposed to be unwholesome is that milk is one of the most favourable mediums for the breeding of disease germs, and sour milk in towns is therefore likely to be infected.—A. de A. Donisthorpe, Num Num, Nylstroom.

WHITEWASH.

Noticing in your July, 1908, *Agricultural Journal*, several recipes for lime washes given on page 620, I herewith have pleasure in forwarding you another recipe which may possibly prove of greater service and lasting quality than those already given, as mentioned above.

The "White House," the American President's official residence at Washington, gets its name originally from the wonderful whiteness of the wash it was coated with. An old newspaper gives the composition of this whitewash as follows:—

Take half a bushel of unslaked lime; slake it with boiling water. Strain through coarse canvas, and add a peck of salt dissolved in

warm water. Then put in three pounds of ground-rice boiled to a thin paste and poured in hot; half a pound of whiting and one pound of fine glue dissolved in warm water. This mixture is said to last practically for ever, and to be superior to white paint.—WILLIAM WAYNE, Barberton.

THE GRAPE FRUIT.

In your *Agricultural Journal* (January, 1909) I have read with great interest the review by Mr. R. A. Davis on the excellent results obtained by citrus fruits exported to the London market during the past season, and one can feel proud of the fact of having established one (if not the first) commercial enterprise of an export trade between Transvaal and European markets.

The rejection of our grape fruit can only be of a temporary nature. Any one who knows the value of the fruit, both as a refreshing beverage in the early morning, and as a tonic, will smile at the simplicity of the London broker.

When once the prejudice of its being "something new" has been got over, then it must have a future on the European market, and the demand for it constantly increase. I feel sorry that the broker has condemned the fruit evidently, by his remarks, without even knowing its value as a "pick-me-up" in the morning, say, after pressing business and late hours in the office overnight.

In the first place it is not an orange, and must have quite different treatment. The manner of preparing a shaddock or grape fruit is to take a sharp knife and cut it transversely through the centre; then cut out the rag and remove pips if any. This being removed the centre will have a copious supply of delightful liquid which, with a little sugar added, is a delicious beverage. Some even prefer the addition of a little port wine. This class of fruit has taken a firm hold in New York markets, and good specimens realise as much as 1s. to 2s. each retail.—J. E. GIBSON.

RESCUE-GRASS FOR WINTER PASTURE.

I am glad to say that I consider there is no grass equal to prairie-grass for winter forage in this part of the country. The sharper the frost the greener it gets. I am thinking of growing this grass on a considerable scale.—W. GOUWS, Daggakraal, Driefontein, via Amersfoort.

Answer.—The grass referred to is the rescue-grass (*Bromus Willdenowii*) which has for several years been distributed by this Department for trial as a winter pasture grass.—J. BURTT-DAVY, Government Agrostologist and Botanist.

SUSPECTED POISONOUS PLANTS: *EUPHORBIA PUGNIFORMIS.*

I have lost several Angora goats lately, apparently from poisoning. By careful observation I noticed the goats eating a species of cactus, specimen of which I forward. Could you inform

me if this plant is poisonous, and further, if the juice would be an antidote to the poison if administered to the animal? I am quite sure myself that it is poisonous—the only question is to find an antidote.

Very early in the spring when food is very scarce this plant throws out rather an attractive blossom which seems to attract goats, and they readily eat it; it appears to have no effect on old goats, but in young ewes it causes abortion, and generally the ewe dies about the third day.

I am rooting it out all over the farm, but, unfortunately, there is a lot amongst the stones, and it is practically impossible to eradicate it, and therefore I should like to know of a cure or antidote. My natives, who have ordinary common goats, only lost two or three, but I lost about twenty Angoras.—F. J. Fisher, Rooipoort, via Volksrust.

Answer.—The plant is known as vinger-poel (*Euphorbia pugniformis*), and has been reported to us once or twice as poisonous to goats, but we have never before had an opportunity to determine whether this is actually the case.

Two pounds of the material which you sent for test was fed by Dr. Theiler to three goats on the 12th November, and the following day they all received another two pounds each. No results were obtained, and the three goats were still alive on 8th January.—J. Burtt-Davy, Government Agrostologist and Botanist.

LUCERNE CULTIVATION.

I started lucerne growing two years ago and made it quite a success. I treated my lucerne lands as follows:—

Sown first week in March under irrigation. First manure land (old manure), then water land well, then plough well. Sow a crop of barley, harrow well two or three times until ground is perfectly fine, then sow lucerne and harrow with a very light harrow. The barley will grow first and will protect the young lucerne from the heat of the sun and will also keep weeds down. By sowing as above the first frost will destroy all remaining weeds. After reaping first crop spread a little manure and do not forget to run the disc harrow over the land, and water immediately, and the lucerne will grow from 12 inches to 15 inches within eight days.

As far as my experience goes lucerne should not be grown on dry lands in this part. Care must be taken not to water lucerne too often on damp lands, and never sow in swamps. My lands are well drained, and I water same once in eight days. I have just reaped half an acre and pressed thirty bales. Of course my next cutting will be much better.—M. Moodie, Hartebeestfontein, District Middelburg.

Answer.—I do not recommend sowing a nurse crop with lucerne as it is usually found that the nurse crop withdraws too much moisture from the soil and the lucerne suffers.—J. Burtt-Davy, Government Agrostologist.

DODDER (*CUSCUTA* SP.)

I enclose samples of a weed which has just made its appearance here and which seems to be very noxious and dangerous. I believe it is dodder. Could you give me any advice as to how to deal with it?—H. M. GUEST, Klerksdorp.

Answer.—The plant sent with your letter is dodder (*Cuscuta* sp.); it is a serious menace to all lucerne crops, and I trust you will see that vigorous measures are taken to eradicate it before it seeds. The best method is to cut off all the infected plants as soon as possible and burn them thoroughly in a good hot fire, taking care that no seed is scattered.—JOSEPH BURTT-DAVY, Agrostologist and Botanist.

With reference to your letter I write to say that our council is destroying the dodder growing in municipal lands and also in some private gardens. Cannot this noxious weed be put in the same category and under the same law as *Xanthium spinosum*?—H. M. GUEST, Klerksdorp.

Answer.—Steps are being taken to have this weed declared a noxious weed and to make its eradication compulsory.—JOSEPH BURTT-DAVY, Government Agrostologist and Botanist.

WEED SEED DISPERSAL.

I would be pleased to know something about a very common plant in this country, which after shedding its yellow petals grows little white florets. It is evidently of the Composite order, with feathery leaves. I enclose two rough photographs and some of the shed white florets. Trusting my description, with the florets and photographs, will be sufficient for identification.—ALEXANDER MENNIE, Johannesburg.

Answer.—The plant of which you enclose photographs is a species of *Ursinia*, family Compositæ, probably *Ursinia annua*. What you describe as "white florets" are not in reality florets, but the white-winged achenes or fruits. These "wings" are tightly folded round the base of the florets till the seed ripens, when the petals wither and the white scales unfold and act as a parachute to the seeds, which are thus carried and spread by the wind.—JOSEPH BURTT-DAVY, Government Botanist.

NATIVE HAY-GRASSES: *PANICUM LAEVIFOLIUM.*

Kindly give me the name of the grass sent herewith. It grows very luxuriantly here, and is well liked by stock.—HENRY LEA, Brereton, Volksrust.

Answer.—The grass is *Panicum laevifolium*, a native annual species which makes excellent hay. Being an annual it has to grow from fresh seed every year, and unless a certain amount is allowed to seed on the lands it is apt to disappear the following season. As the lands become hard it ceases to grow as vigorously as on freshly-broken ground. Unfortunately the seed of this grass does not ripen evenly, and it is therefore rather difficult to collect any quantity, otherwise it might be harvested and sown as a regular farm crop.—JOSEPH BURTT-DAVY, Government Agrostologist.

BUTTER-MAKING IN HOT CLIMATES.

I would be much obliged if you could give me any information as to the making of butter in a hot climate in the summer time.

My farm is 2,200 feet above sea level, and situated in the bush-veld. The thermometer rises occasionally to over 100° F. in the shade. Naturally I have the greatest difficulty in getting the butter to granulate. At the temperature of about 100° this is not surprising, but I notice that the cream skimmed during the week, at high temperature, will not granulate even when there is a drop in the temperature. To-day the thermometer is at 68° F., but in spite of this drop butter will not form.

There is a good deal of moisture in the atmosphere at the present time, and the cattle are grazing on new grass. I do not know if either of these causes would affect the milk to any considerable extent. The roof of the building in which the milk is kept is iron, but it is high and there is always a cool draught of air passing through. In spite of this our climate is very hot.

Each morning when the milk is skimmed the milk is found to be solid curd. I would be much obliged for any information as to (*a*) the keeping of milk sweet; (*b*) the manufacture of butter under the above circumstances. Will you kindly also inform me whether you consider cheese could be successfully manufactured under similar conditions, or is great heat an insuperable obstacle?—J. E. D. TRAVERS, Telunduteka, Sand River, near Pilgrims Rest.

Answer.—I do not wonder you meet with very great difficulty in trying to make butter at a temperature of about 100° F. My article on "Theory of Butter-making," which appeared in the January, 1909, issue of the *Journal* will make it clear to you why it is so difficult for you to make butter at a high temperature.

Cooling the cream from 100° to 68° is not sufficient to solidify part of the fat. Consequently the fat globules remain in the liquid state at the lower temperature, and at the lower temperature there is less tendency to adhesion. I do not think that increased moisture in the atmosphere (probably not much over 50 per cent.), or the new grass, are likely to exert an adverse influence on your butter-making. The excessive temperature is *the* difficulty, and the best suggestion I can give is, "Try to reduce the temperature." I know this is not so easy, as you will have no ice at your disposal, and a small ice machine for making ice artificially is rather expensive.

Ice and machine cooling being out of the question, all you can do is to keep the dairy as cool as possible. You might surround the cream can with a towel, and then place it in a dish with water; this will reduce the temperature somewhat. Another way to reduce a dairy in temperature is a sub-earth duct. An earthenware pipe runs for a couple of hundred yards (250 to 300) underground, and all air that enters the dairy must stream through this duct, as windows and doors are tightly closed. This system again is rather expensive.

An iron roof sounds rather hot. I think it is hardly possible to produce good butter under the circumstances you mention. The remedy is to reduce the temperature, but whichever system you adopt this is very expensive. I do not know the soil temperature in your district, but you could get a cooler dairy of even temperature

by making it underground. I am afraid, however, this would entail too much expense.

Cheese-making can be carried out at higher temperatures than butter-making, and, therefore, I think cheese-making should be possible under the circumstances. It certainly will be difficult, but you will always get cheese however hot it grows, and in butter-making you meet with the trouble that the grain does not form. I am sending you a couple of pamphlets dealing with butter and cheese-making which may be of use to you. The renneting temperature runs from about 79° to about 89°. The churning temperature runs from about 50° to about 62°, hence it is clear it should be easier for you to get the milk at the renneting temperature than to reduce the cream to the churning temperature. Moreover, renneting *may* be done at temperatures running up to 107°.

In cheese-making you should take the milk straight from the cow, then its temperature will be 84-90°. If you rennet at that temperature I think it will be superfluous to "scald" the curds; all you will have to do is to stir.—ROBERT PAPE, Superintendent of Dairying.

CHEESE-MAKING.

I have read with much interest your notes on cheese-making in the July, 1908, number of the *Agricultural Journal*, and would be very glad if you could kindly furnish me with some more definite information on the subject. I should only require plant for about 20 gallons of milk per day, and believe I can buy such for about £15. But I know nothing whatever about cheese-making. Do you think it would be worth while trying my hand at it? I can only get 2d. per bottle for milk, and to have to cart it to town twice a day for that price is not good enough. But is there any market for cheese? I believe good foreign cheese can now be bought here in one shop at least for 1s. per lb. Any information you can give me will be most acceptable.—W. J. HISCOCK, P.O. Regent's Park, Johannesburg South.

Answer.—I am forwarding you a couple of leaflets and pamphlets giving some more details about cheese-making. I do not know whether a £15 plant for cheese-making will be satisfactory. A plant like the one described in *Farmers' Bulletin* No. 29 will certainly cost a good deal more.

If you can get 2d. per bottle for milk I doubt whether it will pay you to go in for cheese-making; 2d. per bottle makes 1s. per gallon. In cheese-making you may realise a little more, but you have the added risk to consider, and to allow for interest and depreciation of the plant. When cheese-making results in 1½d. per bottle of milk being made I think it quite satisfactory, and if it comes to 2d. per bottle I think it is very good indeed. You may reckon to make about one pound of cheese from a gallon of milk, and if cheese is retailed at 1s. you will not get more than 9d. when you supply the shop. This would work out at 1½d. per bottle of milk.

The milk should be put into the vat and turned into cheese as soon as possible after drawing. Some people mix morning and evenings milk in cheese-making, but the quality of the cheese suffers

from this to some extent. To make the best cheese you should make it twice daily. So, in considering what to do you should compare the labour of making cheese twice a day against carting it to town, and further that when you make cheese you will probably realise ½d. per bottle less.—ROBERT PAPE, Superintendent of Dairying.

THE PASTEURISATION AND STERILISATION OF MILK.

I should be very glad to have your advice regarding the pasteurisation of milk in connection with your note on page 597 of the July, 1908, *Agricultural Journal.* What I should like to know is this: Instead of bottles would it not do to get one or more ordinary milk cans and have a tank made for them, leaving the top open whilst heating the milk and closing them on cooling it? They would be less troublesome to clean and more easily manipulated. And about how long will pasteurised milk remain good? Is this the same as sterilising? And, finally, should one have bottles all the same size—would it not do to have the false bottom level instead of in steps.—W. J. HISCOCK, P.O. Regent's Park, Johannesburg South.

Answer.—I quite agree it is simpler to clean milk cans than milk bottles, but I am afraid pasteurisation in milk cans would not answer. The idea is that as soon as the temperature falls the bottles close automatically and re-contamination is prevented. It would be difficult to arrange such an automatic closing for milk cans. If you see a chance of closing the milk cans by hand at the exact moment when heating leaves off, and close them so effectually that no outer air can enter, it might answer. But I am afraid you will find it too difficult.

Pasteurised milk, if properly treated, will "keep" for a very long time; if treated indifferently it will turn sour within twenty-four hours. It is not wise to keep pasteurised milk too long. For, though the milk may look all right, pasteurised milk contains certain germs which may produce poisons if the milk is kept for a certain period.

"Pasteurising" means heating the milk till a fairly high temperature *under* the boiling point, followed by a rapid refrigeration. "Sterilising" is the process of heating the milk (under pressure) till a temperature *well over* the boiling point. There is a marked difference between pasteurised and sterilised milk.

If you take all the bottles of the same size there is no reason why the false bottom should not be level.—ROBERT PAPE, Superintendent of Dairying.

SORE UDDERS IN COWS.

The following reply was sent to a correspondent who enquired for a remedy for sore and burst udders of milch cows:—

I am not perfectly certain as to the condition of the udders to which you refer. If the trouble is simply external sores a little boracic ointment applied to the sores after each milking and seeing that the udders are always wiped dry after milking should suffice. If, however, the trouble is deep in the udder it will be much more troublesome, and if an abscess has formed and burst, leaving a running sore, I fear the cow so affected will lose the quarter attacked. This latter condition to which I refer is due to inflammation, one or

more quarters of the udder going on to suppuration, forming an abscess which eventually bursts, and leaves a sore difficult to heal.

In cases of this kind, when first noticed, the particular part of the udder affected should be well fomented with water as hot as you can keep your hand in, the fomenting to be done twice a day for half an hour. The teat connected with the affected part should be milked well out four times a day. After each fomenting rub in an ointment to the sore part composed of one part of extract of belladonna and six of vaseline. If the udder bursts and you get a running sore, in addition to the above treatment wash out the sore with a strong solution of salt and water.—J. M. CHRISTY, Assistant Principal Veterinary Surgeon.

"ALKALI" SOIL.

I am sending three samples of soil with an efflorescence, and on this soil peas and beans will not grow. Tomatoes are not affected apparently.

The soil is originally the granitic rock of the district, and some Safco garden manure has been used. I was thinking of applying sulphate of lime as a corrective, and trying root crops—potatoes, beet, and cabbage—being under the impression that it might be a carbonate of potash or soda. I should be glad to receive your opinion. If you could also give me an idea of the class of manure likely to supplement what is wanting in these granitic soils I should be greatly obliged.—ALFRED LUCY, Moseley, Barberton.

Answer.—The three samples of soil, each with a white efflorescence on the surface, were received. This efflorescence has been examined and found to consist of sulphate of soda and chloride of soda. The latter is "common salt," and you may be familiar with the other as "Glauber's salt."

These two substances are not nearly so harmful in soils as carbonate of soda, but their presence in considerable quantity has a bad effect on some crops. Their presence may quite well account for your failure to grow beans and peas. The application of gypsum or sulphate of lime would not improve matters, though you are quite right about using this when carbonate of soda is present.

Plants of the cabbage, beet, and mangel type can stand a good deal of this kind of "alkali" in the soil. In some cases, indeed, they seem to benefit from an application of common salt. Potatoes should give a good crop on such a soil, but I fear that their quality would not be satisfactory. Among cereals, barley ought to do better than wheat or oats, and vines and orange trees should be most successful among fruits.

Soils of the type you sent usually contain enough potash, but are often deficient in phosphoric acid, lime, and sometimes nitrogen. If you want a single manure which supplies all three of these, finely ground "bone meal" would probably be best. The only objection to it is that it acts rather slowly, and you would get quicker, if not better, results through using white slaked lime to be followed after a good rain, or after thoroughly harrowing in, by superphosphate. This combination, however, contains no nitrogen, so that for mangels, cabbages, and similar crops it would probably pay you to use a little nitrate of soda in addition.—R. D. WATT, Acting Chief Chemist.

Editorial Notes.

THE ACTING EDITOR wishes to thank his colleagues for coming forward so freely with articles for this issue, and Mr. C. E. Gray, Mr. C. E. Legat, and Mr. R. T. A. Innes for kindly contributing editorial notes.

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DR. MACDONALD, Editor of this Journal, has gone to America on a well-earned holiday. We have had many inquiries as to the objects of this visit; it is, briefly, to study the latest American developments in the application of the principles of dry-land farming. A great deal of interest is being taken in this subject by Transvaal farmers, who are anxious to know, as soon as possible, what results have already been obtained from the American experiments, which are being conducted on an extended scale. These experiments are not yet complete, and it is, therefore, impossible to obtain full particulars of them from the various American Agricultural publications; moreover, such publications rarely give the very latest information available.

Dr. Macdonald has, therefore, gone to see for himself and to record the results on the spot, which he will be able to place before the farmers of the Transvaal on his return. He will probably spend most of his time in the north-western States from Montana to Minnesota and Nebraska. He was invited to address the Dry Farming Conference (held in the city of Cheyenne, Wyoming) on the conditions prevailing in South Africa. Such an opportunity cannot fail to draw from the delegates to that Conference, who will represent all the varied conditions of the arid regions of western North America, valuable suggestions bearing on our South African problems.

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MR. F. B. SMITH, Director of Agriculture, returned to Pretoria on 26th February, after an extended tour in Europe and North America on behalf of the Department. In Canada he visited the Macdonald College and the McGill and Toronto Universities, the Agricultural College at Guelph, Ontario, and the Dominion Experiment Farm at Ottawa; at Guelph he found no less than nine South African students in residence. He also visited the Dominion Department of Agriculture and the Ontario Provincial Department of Agriculture in order to study the relations existing between them.

In the United States he saw the Transvaal Government students settled at their several colleges, and also visited the Agricultural Colleges of Iowa, Illinois, Wisconsin, and Cornell, the Federal Department of Agriculture at Washington, and the grain warehouses, corn exchange, and stockyards of Chicago. After selecting an admirable lot of American Friesland cattle for shipment to the Transvaal, an outbreak of foot-and-mouth disease occurred in the States of Michigan, New York, and Pennsylvania, necessitating the quarantining of the ports, and making it impossible and unsafe to ship any cattle. An outbreak of this disease had not been known in America for several years. Mr. Smith visited the Southern States to look into the tobacco industry, and secured the services of some trained men as assistants for our own Tobacco Division.

Mr. Smith was impressed with the growing tendency of American farmers to devote themselves to the business side of agriculture. They are giving much more time to the economics of farming, the improved treatment of the land, and the reduction of working costs by increased use of labour-saving machinery. They are also paying closer attention to the wants of the consumer. "The old and comfortable idea that the public must take and be thankful for whatever the farmer cares to produce is exploded."

In Europe Mr. Smith visited the Agricultural Colleges at Wye and Holmes Chapel, the Experiment Station at Rothamstead, the Botanical Laboratories at Cambridge, where Professor Biffen carries on his wheat-breeding work, Professor De Vries' botanical laboratories at Amsterdam, the Netherlands Department of Agriculture, and the Agricultural Experiment Station at Wageningen, Holland.

In England and Ireland Mr. Smith purchased for the Stud Farm, Standerton, a number of valuable stallions and brood mares.

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THE EXPORT MAIZE TRADE also received attention from Mr. Smith while in Europe. He reports that except for a few bad samples which should never have been shipped, South African maize is highly spoken of on every hand; the chief difficulty is to get enough of it. Owing to our dry winters, our maize dries better and ships better than that from either North or South America. It is not often that farmers have an almost unlimited market waiting for them before they are ready to supply; it is generally the other way, the market having to be made for the produce. Here is a chance to develop a huge industry, which should not be neglected.

European corn merchants object to a large number of grades, and great trouble has been caused by sending several grades in the same ship, which get mixed up and have to be sorted out at the port of delivery with much added trouble and expense. The best method of dealing with this problem appears to be to collect the several classes and grades at the port of export, until a shipload is ready, and then as far as possible, to send each by separate ship.

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THE SOUTH AFRICAN CONVENTION.—Since the last issue of this journal, South African history has been making with almost unprecedented rapidity. 9th February, 1909, is a date which will be recorded in the future history books of South Africa as that on which the report of the South African National Convention and the Draft Constitution were published. As General Smuts aptly remarked at the public meeting in Pretoria, addressed by the Prime Minister and himself, the last page of this document is, perhaps, the most remarkable. It is apparently for the first time that we find a document of this character signed without a minority report.

The Draft South Africa Act provides that the Provincial Councils shall have power to make ordinances in relation to agriculture, to the extent and subject to conditions to be defined by the united Parliament. We are glad to note that it is not proposed to leave all agricultural problems to the local Councils, for we have always maintained that, in South Africa, a strong central Department of Agriculture was of the utmost importance to the farming community. Such a department should organise and control the scientific research work for the whole of South Africa; should provide—under the laws of the Central Parliament—uniform regulations for the control and extirpation of diseases of stock

and crops, and should have a direct relation to the higher agricultural education of the country.

When this number of the journal appears, the various Colonial Parliaments will be meeting to consider the Draft Constitution. The next three months are pregnant with great issues, and the whole country is watching and waiting the results, with mixed feelings to be sure, but the predominating note seems to be one of hopefulness.

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THE NEW EDUCATION CODE.—Following close after the Draft Constitution for a United South Africa comes the publication of the new code of the Education Department. This document is of particular interest at the present time, as it endeavours to meet the growing demand that school education shall be more practical. As Mr. Adamson points out, education should prepare for life, should develop the power of accurate, independent and self-reliant thinking, and should develop physical dexterity and well-being.

The subject of rural education has an important bearing on the future of agriculture in South Africa. There is an undesirable tendency, all the world over, for people to migrate from the rural districts to the large towns. This is due to several causes: a craving—perhaps acquired rather than natural—more developed in some natures than in others, for more social intercourse than can be obtained in ordinary rural life; neglect of the best development of country home life; an unwholesome public sentiment in favour of office and shop work as being "more respectable" than that of a farm; the tendency of modern education to fit young people for such positions and to unfit them, both in tastes and ability, for farm life, in other words, to train them to become clerks, doctors, lawyers, and preachers rather than farmers. There is an unfortunate idea prevalent that a lad with brains should not "waste" them on farming; in fact, that "any fool can be a farmer." The opposite is really the case; to make farming profitable, with increased competition and reduced prices, requires training in scientific agriculture and good business management.

The problem of rural education is a most difficult one, which is attracting the attention of educationalists in many parts of the world, and a better system is gradually being evolved. We believe that much can be done to stem the tide of migration from the country to the towns, by arousing in the children of the country schools an interest in farm life and the natural objects of the veld, developing their powers of observation, and giving them—as they become old enough—some elementary teaching in the scientific principles underlying agricultural practice. We are particularly glad, therefore, that Mr. Adamson has provided for a special departmental branch of rural education, which will include a course in nature study, and the formation of school gardens.

* * * *

WHAT IS NATURE STUDY?—The object of the nature study course is not to teach agriculture, but to interest the children in the plants and animal life on their farms and the adjacent veld; to teach them the simple facts of nature, such as that the plant is a living thing, which feeds and breathes, and to develop and train their powers of observation and comparison. As Professor L. H. Bailey observes, nature study is not the study of a science, as of botany, entomology, geology, and the like. It takes the things at hand and endeavours to understand them without reference to the systematic order or relationships of the objects. It

simply trains the eye and the mind to see and to comprehend the common things of life, and the result is not directly the acquirement of science, but the establishing of a living sympathy with everything that is. We teach either for the sake of imparting the subject itself, or for the sake of the pupil. When we have the pupil chiefly in mind, we broaden his sympathies, multiply his points of contact with the world, and thereby deepen his life; a graded or systematic body of facts is of secondary importance. In other words, when the teacher thinks chiefly of his subject, he teaches a science; when he thinks chiefly of his pupil, he teaches nature study. The child always loves nature; but when he becomes a youth, and has passed the intermediate years in school, the nature instinct is generally obscured and sometimes almost obliterated. The perfunctory teaching of science may be a responsible factor in this result; let us rather develop his natural instincts in this direction.

* * * *

AGRICULTURAL DEVELOPMENT IN BOSNIA AND HERZEGOVINA.—Interesting developments have recently been taking place in the Balkan States of Europe, owing to the absorption of Bosnia and Herzegovina into the Austro-Hungarian Empire. These States have an area of about 20,000 square miles. The politics of south-eastern Europe will have little of interest for our readers, except as they have a bearing upon its agricultural development. Austro-Hungary is a large producer of horses and of maize, which latter is shipped to northern Europe. Its Government has adopted an advanced policy for the development of the agriculture of its empire, and since the administrative and military occupation of Bosnia and Herzegovina in 1878 has extended that policy to these two States, with remarkable results. In 1878, we read, there were no railways and but few wagon roads in these provinces; schools were almost unknown, and the average number of murders reached ten thousand a year out of a population of less than two millions. At the present day, the homicides do not average more than six a year; there are nearly eight hundred miles of railways, and education is free, though not compulsory, in nearly twelve hundred elementary schools. Besides these, there are about twenty higher schools, a dozen advanced schools for girls, industrial and technical schools in most of the larger towns, and several training colleges for teachers. A writer in the American *Outlook* remarks: "Where in the world has there been, during a period covering the past three decades, a more remarkable exhibition of administrative reform?"

A chief feature of the teaching is that of practical agriculture. This is necessary where the agricultural population numbers nearly nine-tenths of the whole, and where, despite the soil's fertility, prior to 1878, agriculture had been in a shockingly primitive stage of development. Over half of the land is occupied by forests, and the timber export, expedited by the introduction of railways, is now very large. Other prominent exports are those of cattle, sheep, goats, and horses. Sheep-skins and goat-skins are sent in great quantity to England and America. The provinces are famous for their superabundance of fruit, the export of prunes being especially large.

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SCAB CONFERENCE.—A conference of field cornets and of delegates summoned by the Minister of Agriculture was opened by Lord Selborne in the Town Hall, Pretoria, on the 8th March. The primary object of the gathering was the discussion of the proposed new scab regulations designed to deal more effectively with the prevention of this pest.

In his opening remarks, His Excellency stated that he considered the scab problem as one of the most important before the farming population of the Transvaal at the present time. By the eradication of scab a greater price would be received by the Transvaal farmers for their wool, and this increase might reach hundreds of thousands of pounds. Referring to the question whether it was possible to eradicate scab, he pointed to Australia as an illustration, remarking that if Australia is clean, why not the Transvaal? If we are going to argue that in South Africa scab cannot be eradicated, it must be on the assumption that the farmer in South Africa is less capable than his fellow farmer in Australia, and that, he said, he was not prepared to admit. His Excellency stated that among his own sheep in the south of England he had seen scab but once in twenty-five years; that case was among some imported animals, and was promptly and effectually dealt with. He referred to the necessity for co-operation between the Government and the farmers to carry out the regulations and also between the farmers themselves, in order to eradicate the pest. There were cases in which the regulations might press hardly on individuals, but in such a matter it is of the utmost importance that the individual should sacrifice himself for the good of all.

General Botha pointed out that scab had been on the increase since the Transvaal had again started sheep-farming after the war. It seemed as though they were never to reach the point of freedom from scab attained by other countries, and he attributed this to lack of sufficient co-operation amongst the farmers. He was glad to see that the desire to eradicate the disease was spreading among them, and it was the intention of the Government to help those who were doing their best. As regards those who did not want to work to stamp out the disease, it would be better to force them to dip their sheep. Scab was doing the South African wool market a great deal of harm, as was clearly indicated by the fact that South Africa gets 4d. a lb. less than Australia for its wool. He concluded with the remark: "If the farmers will not help, everything will be in vain, but, as I know our farmers well, I am certain that they will co-operate with the Agricultural Department in fighting and eradicating this disease."

* * * *

PRODUCE-JUDGING.—In the judging of produce at our Transvaal Agricultural Shows there is room for improvement. We would strongly urge upon the secretaries of societies the desirability of securing the services of competent and expert millers to judge wheat, flours, and meals. For forage and hay of various classes a market master or produce merchant in a large way of business would probably be the best judge of the relative commercial value of exhibits. The difficulty is to get such men who can spare the time to spend two or three days to attend a show in a remote part of the Colony, while the local merchant, however honourable, knows too well the character of the exhibits of his customers to ensure their confidence in the impartiality of his judgments. Not all produce dealers make good judges; we have seen some most unfortunate exhibitions of incompetence in judging by them.

We are glad to note that the committee of the Heidelberg Agricultural Society has followed the recommendation which we made last year, that no exhibitor of produce be allowed to take more than one prize in one and the same class. It is manifestly unfair to other exhibitors, and tends to reduce competition if the exhibitor of the first prize bag of oats is allowed to have the second prize for another bag of oats from the same field. The

case is altogether different with live stock, where the individuality of the exhibit makes such awards permissible.

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THE MINERAL CONSTITUENTS OF FOODS.—In the December, 1908, number of the *Journal of Agricultural Science*, Mr. H. Ingle, late Chief Chemist of this Department, gives an interesting paper on this subject, accompanied by a table of analyses of certain Transvaal grown foods. Discussing the problem of osteoporosis in horses, donkeys, and mules, Mr. Ingle concludes that "whether osteoporosis be due to a specific organism or not, a condition of the bones of animals similar to that which results from the disease may be induced by the use of a diet containing a low ratio of lime to phosphorus pentoxide." He considers that it is not the poverty in lime and phosphoric acid of South African grown produce (as compared with European grown food-stuffs of the same kind) which is to be blamed for the prevalence of bone troubles among animals here, but rather the practice of feeding such animals almost exclusively upon a cereal diet. Finally, Mr. Ingle recommends that in feeding animals in South Africa, a food-stuff relatively rich in lime—e.g. a leguminous fodder crop like lucerne or cowpeas—should be substituted for a portion of the usual ration of oat-hay. Moreover, he adds, the more extended use of leguminous foods would improve the rations of animals in other ways, notably by narrowing the albuminoid ration.

* * * *

TRANSVAAL GOVERNMENT AGRICULTURAL STUDENTS IN AMERICA.—We are in receipt of an interesting letter from one of the eight Government students, in which he states that he and his friend are enjoying their life at Cornell, and are getting on well with their studies. They speak of being perfectly satisfied with everything. Christmas Day was spent in the beautiful city of Toronto, Canada, where they joined eight other South Africans (several being private students) in a home-like Christmas dinner.

* * * *

FARM HEDGES.—Mr. Henry Lea, of Brereton, via Volksrust, writes that he has planted nearly a mile altogether of honeysuckle (presumably *Lonicera halliana*), to twine up wattle-sticks plaited in and out of barbed wire fences around his paddocks to afford shelter in winter. So far it seems to answer well.

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THE RUBBER INDUSTRY IN PORTUGUESE EAST AFRICA.—Through the courtesy of the Vice-Consul for Portugal, we have received an interesting report by Mr. W. H. Johnson, F.L.S., Director of Agriculture to the Moçambique Company, on the rubber industry in Manica and Sofala.

In addition to the native wild rubbers, of which *Landolphia Kirkii*, Dyer, seems to be the most abundant, there are some fairly large plantations of Ceara rubber (*Manihot glaziovii*), in all about 75,000 trees. The Ceara tree appears to have been introduced into Manica and Sofala in 1895. "Reports with regard to the amount of rubber produced are not very encouraging, but this is doubtless due to ignorance of the best methods of extracting the rubber, and to the tapping of immature trees."

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MAIZE EXPORTS.—The following official figures on the maize export of 1908 have been prepared by the Natal Government Railways.

The total amount exported through Durban for the year was 545,991 muids, valued at £251,494, as compared with 428,663 muids in 1907, valued at £171,169. The increase amounts to 117,328 muids, valued at £80,325.

RETURN OF MAIZE EXPORTED BY SEA FROM PORT NATAL DURING THE YEAR 1908.

Month.	United Kingdom.	Continent	Canary Islands.	Australia	Cape Colony	Canada	Delagoa Bay, etc	Bombay	Other Places.	TOTAL.	VALUE.
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	£
January ...	4,649,292	3,889,530	590,000	1,356,778	2,097,430		4,000			12,587,030	26,978
							Inhambane.				
February ...	7,304,171	7,350,310	854,200		1,525,900		200		—	17,034,820	35,849
March ...	842,647	2,330,835			3,377,400				-	6,550,872	14,518
April ...	246,400	883,310			2,025,729		—	104,560		3,259,999	7,703
May ...	250,800	53,400		-	1,100,600			-	-	1,704,800	4,003
June ...	267,865	1,926,936		419,800	3,545,782	—		-		6,160,383	13,961
July ...	246,730	5,211,656	221,070	1,555,156	5,094,378				-	12,308,990	28,011
August ...	3,202,390	9,149,166	559,800		5,830,671			-		18,712,007	43,554
							Beira.				
September ...	3,353,924	12,595,827	711,000		2,259,305	183,512	5,000	-		19,108,598	41,500
October ...	747,632	2,401,635			2,036,741			- -	8,615	5,257,623	13,278
November ...	292,150	- -	-	65,600	1,512,269		-		8,830	4,878,849	14,104
							Rhodesia				
December ...	4,900	-			1,259,404		40,000	—		1,304,304	5,035
Total 1908 ...	21,408,891	45,855,644	2,936,070	3,377,334	34,965,589	183,512	49,200	104,560	17,445	109,198,275 (545,991 muids)	£251,494

STATEMENT SHOWING NUMBER OF BAGS (AVERAGING 200 LBS.) OF MAIZE RECEIVED AT POINT FOR EXPORT DURING 1908 WITH COLONY OF ORIGIN.

NATAL.	ORANGE RIVER COLONY.	TRANSVAAL	TOTAL.
Bags.	Bags.	Bags.	Bags.
289,535	141,203	114,825*	545,563

* As against 43,764 muids for 1907 and 3,716 for 1906.

Effect of Rainfall on the Season's Crops.—The excessive rainfall of January, February, and early March has caused some loss among the potato crops on low-lying lands, has made it impossible to secure the usual crop of lucerne hay, and, more serious still, has drowned out the lucerne plants on lands which had not been subject to flood for years. Haymaking has been almost impossible. Oat forage crops have suffered severely. Grapes and tomatoes have also been injured.

Teff grass, Boer manna, and the various millet crops now being grown have shown remarkable resistance both to the severe drought of December and the subsequent wet period, and good crops will be harvested if the weather clears up in time.

The later sown maize crops have in some places suffered from lack of proper pollination, probably owing to coagulation of the pollen. In some places, however, the maize stands have never been so promising, and as far as we have been able to learn at present the crop has suffered less than was expected, and owing to the greatly increased acreage it is probable that it will beat the record.

Weather Report, Rustenburg District.—Mr. John Todd, of Naauwpoort, P.O. Olifantshoek, Rustenburg, reports as follows on the effect of the February rains on the crops in his district :—This month has been one of rain and clouds, as there were only four sunny days the whole month through. In the beginning of the month there were thunder showers. These were succeeded by slow mist rains from the north and north-east. The veld is in good condition, and the grass is high and seeding. The ground is very wet, and every small spring gives forth its stream ; in parts the veld has become a marsh. All stock, generally, are in good condition, although through poor shelter sheep have perished from the rain ; no cases of horse-sickness in this vicinity occurred in February. The grain crops are splendid, some mealie plants growing over eight feet high ; they have had to be well hoed owing to the quick growth of weeds. Tobacco is not a great success. There is too much moisture in the air and too little sunshine : without drying flues the farmer finds that ripe tobacco after being cut inclines more to rot than to dry. Other crops are good. The deciduous fruits are now practically finished. Trayfuls of cut fruit, set out to dry, have been thrown away. The fruit has fallen off and rotted on the ground. The farmers require a drying machine, or a change in the law so that they can distil brandy and sell it.

The Pan-African Veterinary Conference.—Although not the first Inter-Colonial Veterinary Conference to be held in South Africa, the meeting convened at the suggestion of the Minister of Agriculture, and lately sitting in Pretoria, is the first to which the term "Pan-African" could be appropriately applied, including as it did professional representatives from the Cape Colony, Natal, Rhodesia, Orange River Colony, Basutoland, Swaziland, Bechuanaland Protectorate, German West Africa, Portuguese East Africa, Madagascar, and the Belgian Congo. But although the Conference has on this occasion assumed cosmopolitan characters, and would have been even more widely representative had time permitted, the original object for which the first Inter-Colonial Veterinary Conference was called together has not been lost sight of. This object was the discussion of ways and means for presenting an united front against inroads

of those diseases of stock which endanger the prosperity of South Africa as a whole.

In former times when the pacification of the Continent was not yet accomplished, when spheres of influence were little more than a name, and when an extended incursion beyond the coast line was an impossibility unless it assumed the character of a military expedition, there was perhaps no crying need to concern ourselves about anything happening beyond our boundaries; but with the establishment of law and order, the extension of railways, and the opening up of trade routes which penetrate to the very heart of the country, the position is greatly altered, and it is now quite as desirable for defensive purposes that we should know what is going on in Congo Free State as it is that we should know how matters stand in the Orange River Colony and in Natal.

At the earlier Conference many of the Colonies which sent delegates were perforce represented by laymen, but practically all have now recognised the desirability of obtaining professional assistance and advice. As a result of the recommendations made at these earlier meetings every Colony in South Africa between the Cape and Zambesi, and many lying still further north, has established the nucleus of a veterinary service, which, although not so elaborate as might be desired, forms an admirable line of defence which greatly diminishes the risk of unexpected invasion by an epidemic of animal disease. Excellent, however, as this organisation is, it does not suffice for our complete protection, as there are still many parts of the Continent in which hitherto unrecognised diseases of vast economic importance may yet lurk, and in order to guard ourselves still further the institution of a system of veterinary surveys by specially trained and qualified officers, such as was advocated at the recent Pretoria Conference, would be of inestimable value.

The proceedings at the Conference have been so fully reported in the daily press that it is scarcely necessary to enter into a detailed commentary here; perhaps the most wholesome and inspiring feature of the recent meeting was the earnest desire manifested by those present to work together harmoniously for the more effective suppression of disease, not only in the Colonies which they represented, but generally throughout South Africa. It is beyond question that meetings conducted in such a spirit, where each professional man vies with his neighbour in suggesting practical expedients based on actual experience for the control of diseases of stock, can be productive of nothing but good

THE ABNORMAL RAINFALL.—We are indebted to the Director of the Government Observatory for the following note:—Soon after the New Year a rainy spell set in, and with very short intermissions it has continued until the moment of writing (6th March) and it seems likely enough to continue for some time yet. As far as our exact records go—that is about twenty years back—this is by far the wettest spell known. The rainfall in January at Pretoria and Johannesburg was just on double that of any previous January, and February also furnished a record. The rainy season, as all our readers know, is for statistical purposes counted from the 1st July in one year to the 30th June in the next, so that only eight months of our present rainy season is completed, yet such has been the heavy rain of the last six weeks that the total exceeds that of any previous season.

Generally the whole of the Transvaal has received its share of these great rains, but a glance of the rainfall returns published in the present

journal shows that the north-west of the Waterberg and the west portion of the Zoutpansberg have only had a normal rainfall.

The figures for Pretoria and Johannesburg brought up to date, are :—

	ins.	days.
Pretoria (Arcadia) :		
July, 1908—February, 1909 (eight months) ..	38.68	83
Add to 9 a.m., 5th March	2.79	4
Total	41.47	87
Johannesburg (Joubert Park) :		
July, 1908—February, 1909 (eight months) ..	42.98	97
Add to 9 a.m., 6th March	2.36	5
Total	45.34	102

The twelve months' average at Pretoria is about 28 inches, and at Johannesburg about 31 inches.

Undoubtedly the absence of sunshine and the excessive rains have directly done harm to the farming industry, but in the long run the country will benefit—everywhere dried-up springs have burst out again and even if no rain fell for six months, water would be plentiful. Many old pans have become partially filled, but the testimony of old residents proves conclusively that in 1887 and in the 70's the country was damper than it is to-day.

A few such seasons as the present (but perhaps not quite so much rain) would be of much value.

The following heavy rainfalls in last January are noteworthy :—

District	Place	Inches	Days
Lydenburg	Lunsklip	45.13	24
Zoutpansberg	Woodbush Forest	43.95	24

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AGRICULTURAL SHOWS.—Local agricultural shows have suffered a good deal from the heavy rains. The Lydenburg Show has been postponed until next year ; the Volksrust show was postponed for a week, thereby clashing with that of Middelburg. The swollen state of the rivers and the heavy roads prevented such a large attendance as could have been desired. The hay stuffs, cereals, and other produce showed the injurious effect of excessive moisture, in their inferior quality.

There has, up to the time of writing, been a notable deficiency in the maize exhibits ; at Volksrust there were only five exhibits between four classes of maize , this is partly accounted for by the heavy demand for seed last season, and also by the high prices which then obtained for bulk maize.

The introduction by this Department of wheats suitable to the High Veld is already bearing fruit, and there were some fifteen entries at Volksrust ; among these Red Fife was pronounced by practical millers to be the best wheat shown, the others being Victoria, Rietti, Medeah, Fourie, New Era, Jordaan's corn, Spring wheat, and Talavera, with one or two others unnamed. The principal exhibitors were Mr. F. le Roux and Mr. W. Gillespie, though three or four other farmers also exhibited.

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HEAVY RAINFALL NOT CONFINED TO THE TRANSVAAL.—It is interesting to note that almost at the same time that the Transvaal was suffering from floods, California, on the other side of the globe, was undergoing a similar experience. The storm started on the 31st December,

and with the exception of three days there was a downpour every day up to the 16th January. The total rainfall during the storm having been 5.71 inches. A second storm followed on the 20th January, doing great damage to crops and railway lines.

LONDON WOOL SALES.—Messrs. Buxton, Ronald & Co., Wool Brokers, London, write under date 13th February that at their first series of Colonial wool auctions there was a fair proportion of carefully cleaned wools shipped on growers' account, and these met a very good reception at the hands of buyers. A fair quantity of South African wool was offered, the market for which, at the outset, showed prices unchanged from December currency, but as the sales progressed competition was found to be limited, and prices for all descriptions of grease gave way about five per cent. The Bedford district of Cape Colony sent the largest quantity, which sold up to 10½d. for well classed clips of nice quality grease. A few nicely bred and cleaned clips came from the Orange River Colony, which realised up to 10d. per lb. Natals were meagrely represented and sold from 8d. to 10½d. per lb. The auctions lasted fifteen days, at an average (for all wools) of 13,103 bales per diem, as against 11,976 bales at the corresponding series of 1908.

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JOHANNESBURG LIVE STOCK MARKET.—Mr. Alfred Webb, Produce Agent, Johannesburg, writes under date 2nd March :—

Since my last notes the live stock section of the produce market in Johannesburg has been very depressed, and prices are to-day lower than they have been for many months past.

The market is well supplied with both beef and mutton, and owing to the enormous supplies almost daily received, prices have declined all round in consequence There is still a large quantity of country killed meat coming to hand, and therefore farmers should at present only send forward very best quality if they wish to sell to advantage. The extremely wet weather we have had during the last few months emphasises the necessity of sending stock forward in covered trucks whenever possible.

Current rates at time of writing are as follows :—

Slaughter bullocks, 30s. to 33s. per 100 lbs., upon a dressed basis.

Merino hamels, 4¼d. to 4½d. per lb., upon a dressed basis.

Capes, 4d. to 4¼d. per lb., upon a dressed basis

Goats, 3½d. to 4d. per lb.

Tollies and heifers, £4 10s. to £6 10s. per head.

Donkeys, £4 to £7 each.

Mules, £13 to £30.

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THE PERMANENT INDUSTRIAL EXHIBITION at Pretoria, now being organised by the local branch of the S.A. National Union, to which reference was made in our last issue, is to be opened in May next. The scope of the scheme has expanded since its inception and the varied nature of the exhibits should make the Exhibition of considerable interest and educative value, besides providing an excellent means of advertisement for the South African producer. A series of lectures and demonstrations, to be held in the exhibition building, is being arranged. The monthly journal published by this Society, which is sent post free on application, is a useful record of the progress and possibilities of South African

industries. The annual issued by the Head Office of the Union, at Capetown, which is described in the preface as an experiment, contains many valuable contributions and much useful matter, besides an index of South African growers and manufacturers, which conveys some idea of the extent to which the development of Colonial industries has attained.

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CHARCOAL MAKING.—Suction gas engines are coming more and more into favour as a source of power in the outside districts of the Transvaal on account of their low working costs. As a consequence, the consumption of charcoal, which is practically the only fuel used for these engines in places remote from railway lines, is increasing very largely. It is estimated that at least 100 tons are at present consumed monthly.

The attention of the owners of such engines and of people engaged in manufacturing charcoal is specially drawn to an article by the District Forest Officer, Woodbush, appearing in this issue, in which full information is given of the best and most economical method of manufacturing charcoal of good quality.

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PEA-NUT HARVESTING MACHINERY.—A considerable acreage in the Upper Bushveld has been planted experimentally to pea-nuts this year, and we are hoping for a good yield which will demonstrate how far this crop will prove remunerative under local economic conditions. The Department has on order some American pea-nut harvesting ploughs, as shown on Plate 84. On the same plate is shown an American pea-nut planter.

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ADENIA POISONING.—The first of our coloured illustrations represents a species of *Adenia*, also known as *Modecca digitata*, family Passifloraceæ, which is commonly met with in the Upper Bushveld. The particular specimen illustrated was obtained by the Police at Schurweberg, in the Pretoria District, where it is said to be common in the kloofs, and is believed to have caused the death of two native children who ate the pips.

A chemical analysis was made at the Government Analyst's Laboratory, Johannesburg, but owing to the small amount of available material, no definite conclusions were reached, and it still remains somewhat uncertain whether death was due to this or to some other cause, but the balance of evidence is on the side of the Adenia being poisonous. A case of poisoning, attributed to this plant, has since been reported from the Waterberg District, from which a coloured child died, while a white child was made very ill. Yet another case from the Pretoria District, in which this plant has been suspected, has been reported, but no details are available. The brightly coloured fruits are too attractive to children, and the plants should not be allowed to grow promiscuously in the immediate vicinity of houses.

Adenia venenata, Forsk., of N. Africa, appears to be poisonous. Trimen states (*Flora of Ceylon*) that the fruit of *Adenia palmata* is poisonous, and has caused death, and Hooker states that the root of the same plant is said to be poisonous in India.

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XENIA IN MAIZE.—The second coloured plate illustrates Xenia in the maize plant. The ear bearing black, white, and yellow grains is the second generation ear of a cross between Black Mexican and Adams Extra Early.

which shows the splitting out into black and white, flint and sugar, referred to on pages 461-2.

In addition to this, and owing to the fact that the ear was not bagged, and the plants grew within a short distance of another sort, a second, accidental, cross was obtained, this time with a yellow flint.

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JAPANESE IVY NOT POISONOUS.—A false idea has gone abroad in Pretoria, that the "Japanese Ivy," *Ampelopsis tricuspidata,* is poisonous. We are glad to say that this accusation against a favourite ornamental creeper is totally unfounded. It appears to be due to a confusion caused by recent inaccurate descriptions of the leaves of this harmless plant and those of the dangerous "Poison Ivy," *Rhus toxicodendron,* of North America, which is not cultivated in South Africa, and which is not related to the *Ampelopsis.*

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MAIZE MARKET REPORTS.—We are advised by the General Manager of the Central South African Railways, whose keen interest in the maize export trade is well known, that he has arranged that copies of the market reports on maize and oats, which are posted weekly from England, can be seen on application at the Station Masters' Offices on the C.S.A.R. system, arrangements having been made for the information to be sent weekly to the Station Masters We hope that this fresh effort to meet the needs of farmers will prove of service to them.

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BIRDS OF PREY.—The South African Ornithologists' Union has published a useful pamphlet on the South African Birds of Prey and their Economic Relations to Man, by Mr. Alwin Haagner, M.B.O.U., an assistant in the Transvaal Museum, nicely illustrated by photes from life by Mr. R. H. Ivy of Grahamstown. It should be useful in giving farmers and school teachers some knowledge of the habits of these birds, and enable them to discriminate between the useful and the harmful birds of prey. As Mr. Haagner wisely points out, there is far too much indiscriminate slaughter of these birds, just because some of them are harmful, and in spite of the fact that many of them are of the greatest use to the farmer.

* * * *

DISPERSAL OF EXOTIC WEEDS.—An interesting case of the dispersal of noxious weeds is recorded in the *Journal of Agriculture of South Australia* for November, 1908. Two poisonous species of Cape tulp, *Homeria miniata* and *Homeria collina,* have become introduced into South Australia, the latter being sometimes cultivated in gardens for the sake of its handsome flowers. Experiments have been conducted which show that, as is the case with our Transvaal yellow tulp, *Homeria pallida,* these plants are poisonous, but they are carefully avoided by animals that regularly graze on land infested with them. There is danger that hungry animals, newly imported into an infested district, may eat these tulps with injurious consequences.

* * * *

WHEAT GROWING IN ENGLAND.—Mr. Primrose McConnell, author of several useful farm manuals, and at the same time a practical farmer, anticipates a revival of wheat cultivation in England owing to improved methods of cultivation and the use of labour-saving machinery, which have made it possible to grow wheat at prices impossible thirty years ago.

Mr. J. B. Bright, well known to visitors as Superintendent of the Botanical Experiment Station at Skinner's Court, Pretoria, has left the Service in order to engage in farming on his own account. We join with others who have enjoyed a hospitable cup of tea at Mr. Bright's house, in wishing him every success.

* * * *

New Process of Sterilizing Milk.—According to the *North British Agriculturist* of 21st January last, as quoted in "Nature," a new process of sterilizing milk has been tried at Edinburgh under the superintendence of the inventor, Dr. Budde, of Copenhagen. It depends on the presence in milk of an enzyme, catalase, which decomposes hydrogen peroxide with liberation of oxygen. The milk is heated to 120° F., and treated with hydrogen peroxide; after a time the pathogenic organisms are destroyed, and the milk is run into sterilized bottles fitted with air-tight stoppers, and is then ready for delivery.

It is of interest to note that Klerksdorp Agricultural Society will hold its eleventh annual show at Klerksdorp on 26th and 27th May, 1909. We are pleased to learn that the public is taking greater interest in it than hitherto, and altogether a much better show is anticipated this year than has ever been held before.

The society has spent over £6,000 on the grounds and buildings, and stall accommodation is provided for over 350 entries. We wish the society every success with its forthcoming show.

Agricultural Notices.

Veterinary Division.

ARRANGEMENTS FOR FORWARDING PATHOLOGICAL SPECIMENS.

It is hereby notified for general information that special arrangements have been made with the Central South African Railways for forwarding pathological specimens for examination in the Veterinary Bacteriological Laboratory, and all such specimens can be sent carriage forward, if addressed to the Government Veterinary Bacteriologist, Wonderboom Station (for Laboratory Siding), and distinctly labelled "Scientific Specimens for Examination." The Government Veterinary Bacteriologist is at all times glad to make examinations and to report on pathological specimens, but farmers and others sending such are earnestly requested to write full particulars of the animal from which the specimen has been taken and to post such in time to be delivered before the arrival of the specimen, or, in case of urgency, to telegraph. The importance of doing this is urged, since occasionally, when not previously advised, specimens have arrived in too decomposed a condition for examination.

F. B. SMITH.
Director of Agriculture.

Office of the Director of Agriculture,
1st October, 1907.

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SPONZIEKTE OR QUARTER EVIL.

Vaccine for the prevention of this disease can be obtained through the Government Veterinary Surgeons, who will give instruction in the method of vaccination, and through whom also the necessary instruments can be obtained. The price of the vaccine is 3d. per double dose.

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PORTS FOR ENTRY OF STOCK.

The following are the ports for entry of stock into this Colony from the neighbouring territories:—

	Days on which open for the examination of Stock.
Vereeniging	Daily.
Volksrust	"
Villiers Drift	"
Christiana	"
Roberts Drift	Thursdays, Fridays, and Saturdays.
Schoemans Drift	Mondays and Thursdays
Buhrmans Drift	Saturdays.
Fourteen Streams	Wednesdays.
Coal Mine Drift	Thursdays.
Mosymiani	Saturdays.
De Langes Drift	Tuesdays.
Commando Drift	Alternate Wednesdays.
Komati Poort, through which stock not provided for under Clause 5, Government Notice No. 834 of 1903, will only be allowed to proceed by rail, to be examined at Machadodorp	By special arrangement with the P.V.S.

Division of Botany.

INJURIOUS WEEDS.

Owing to the fact that of late several newly-introduced and injurious weeds have made their appearance in the Transvaal, farmers are earnestly requested to take careful notice of any new plants which have appeared on their farms and which seem to have a tendency to spread. When such are discovered, specimens of the plant bearing flowers and, if possible, seed should be forwarded to the Government Botanist by whom they will be examined and reported upon. They should be forwarded in the same way as specimens of poisonous plants.

* * * *

PLANTS POISONOUS TO STOCK.

The Division of Botany is co-operating with the Division of Veterinary Bacteriology in an investigation of the poisonous plants of the country.

Farmers who lose stock through poisoning are asked to send specimens of suspected weeds for identification and further study.

Specimens may be sent by letter post, free of charge, if addressed: "The Government Botanist, Department of Agriculture, P.O. Box 434, Pretoria." Envelopes should be clearly marked O.H.M.S.

* * * *

BURWEED.

The Department is taking vigorous action for the eradication of Burweed (*Xanthium spinosum*) and Mexican Poppy or "Scotch Thistle" (*Argemone mexicana*). Farmers who have complaints to make about Burweed on public roads or outspans, Crown lands, or native stads or locations should write to the Government Botanist, Department of Agriculture, P.O. Box 434, Pretoria.

* * * *

COCKLE-BUR (*Xanthium strumarium*).

On account of the dangerous character of this weed to wool and mohair growers, farmers on the Aapies, Pienaars, and Crocodile Rivers are advised to keep a sharp look-out for its appearance, especially on the banks of the rivers, and to root out the plants before they scatter seed. Any farmer who is in doubt as to the identity of Cockle-Bur can send specimens to the Botanist for identification.

Division of Forestry.

SALE OF HEDGING FROM IRENE NURSERY.

It is hereby notified for general information that the sale of Hedge Plants from Irene Government Nursery has been discontinued. Forest trees will be disposed of as formerly.

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The price list of seeds and trees supplied by this Division can be obtained free of charge on application to the Conservator of Forests or the Government Printer, Pretoria.

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Farmers' Bulletin No. 8, "The Propagation of Trees from Seed," can be obtained, free of charge, on application to the Government Printer.

Chemistry Division.

INSTRUCTIONS FOR THE SAMPLING OF SOILS.

There are many ways of taking samples of soil. The following, perhaps, will be found most convenient in this country:—

(1) Having selected a representative spot, the vegetation upon it is removed, and a hole is dug with a sharp spade to a depth of about 15 inches. One side of the hole is then trimmed with the spade so as to be smooth and vertical, the hole being cleaned out. A slice of uniform thickness, about 3 or 4 inches, is then removed by the spade down to the depth of one foot. This slice is placed on a clean board or sack and mixed with similar slices, obtained in the same way from other parts of the field. Finally, all the samples are thoroughly mixed together with a trowel or the spade, the sticks, large stones, and roots removed, and a portion of 6 or 7 lbs. placed, with a label giving details, in a clean bag or box and sent for analysis.

(2) Another, better but more laborious, method is to have wooden boxes, 6 inches square and 12 inches deep, to hold the samples. A large hole is dug with a spade at the selected spot, and a square upright block of soil is left in its centre. This is carefully trimmed with the spade until a box will just fit over it. The upper surface of the block of soil is freed from vegetation, the box inverted over it, and forced down. The spade is next slipped under, and the box with its contents removed, a label giving particulars of the soil put in, and the lid screwed on. In this way a sample of the soil (and often the sub-soil *in situ*) is obtained which can be examined in the laboratory.

WHAT TO DO WITH THE SAMPLES.

In all cases full details as to the exact locality, date of collection, depth, crops borne, previous manurial treatment, and other circumstances connected with the soil should be enclosed with the sample. These should be written in pencil, as ink is apt to become damp and run.

Samples should be sent by passenger rail, addressed to the Chief Chemist, the Agricultural Chemical Laboratories, Pretorius Street, Pretoria, and advice of their despatch, together with details of the samples, should be sent by post to the same address.

SCHEDULE OF CHARGES FOR ANALYSIS MADE IN THE AGRICULTURAL LABORATORIES.

		£	s.	d.
1.	Estimation of one constituent in a manure or feeding stuff	0	7	6
2.	Estimation of two or three constituents in a manure or feeding stuff	0	15	0
3.	Complete analysis and valuation of a manure or feeding stuff	1	0	0
4.	Analysis of water—drainage or irrigation	1	5	0
5.	Partial analysis of a soil to determine fertility and manurial needs	2	0	0
6.	Complete analysis of a soil	3	0	0
7.	Analysis of milk, cream, butter, or cheese	0	10	0
8.	Milk—determination of fat and total solids	0	5	0
9.	Milk—determination of fat only	0	2	6
10.	Butter—determination of water and fat	0	5	0
11.	Analysis of a vegetable product—hay, ensilage, roots, etc.	1	0	0

At present no charge will be made to bona-fide farmers. The charges in the above schedule refer to products sent by manure merchants, milk dealers, or others interested in trade. Samples will only be accepted if assurance can be given that they are properly taken and truly representative of the bulk. The right of publishing the results of any analysis is reserved by the Department. Should the examination of any product furnish results which are deemed of sufficient general interest, the charges may be remitted.

Samples of any product likely to be of agricultural importance will gladly be received.

Division of Entomology.

SUPPLIES.

For the benefit of farmers in outlying districts it has been considered advisable to stock the following chemicals for the purpose of exterminating various insect pests It must, however, be remembered that remittances must in all cases accompany the orders for such supplies, and it must be distinctly stated in writing for what purpose such chemicals are required in order to comply with the Poison Regulations.

Arsenate of lead, 1s. per lb., in quantities of not less than 5 lbs.
Arsenite of soda, at 6d. per lb., in quantities of not less than 10 lbs.
Arsenic, at 6d. per lb., in quantities of not less than 10 lbs.
Carbon bisulphide, at 10s. per gallon, in one-gallon drums.
Cyanide of potassium, at 1s per lb., in quantities of not less than 5 lbs.

Division of Horticulture.

SCIONS FOR BUDDING AND GRAFTING.

Cuttings of all kinds of fruit trees may be purchased from the Horticultural Division. Orders should be sent to the Government Horticulturist, Pretoria, who will forward them to the nearest experimental station for despatch.

The price of cuttings is 1d. per foot, and from six to ten buds may be taken from each foot length. Purchasers should allow two buds for each scion to be used for grafting purposes. Cash should accompany order in all cases, including sufficient to cover postage.

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CUTTINGS OF GRAPE VINES.

A large number of cuttings of American resistant vines is available for grafting purposes, and may be had at 15s. per 1,000, on application to the Manager, Government Experimental Orchard, Potchefstroom.

Cuttings of European vinifera varieties, both of table and wine grapes, for the supply of scions are also available at 1s. per dozen.

In view of the fact that phylloxera is now present in the Transvaal, the planting of any vines other than those grafted on American resistant stocks is not advisable.

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FRUIT TREES FOR SALE AT THE GOVERNMENT EXPERIMENTAL ORCHARDS AT ZEERUST AND POTCHEFSTROOM.

The following lists comprise all the fruit trees available for sale by this Division this season. They are grown in order to distribute good bearing varieties as widely as possible amongst our farmers, and for that reason the supply is limited to 200 trees for any individual. The price of all trees mentioned is 1s. each, with the exception of apples, which, being worked on blight-proof stocks, are worth 1s. 3d

Payment may be made on or before delivery, and it is suggested, when purchasers desire to have their trees sent to a railway station, that advantage be taken of the "Collect

on Delivery" system of the Central South African Railways; when this is not done, cheques or post office orders may be made payable to the Manager, Government Experimental Orchard, Potchefstroom, or to the Assistant Horticulturist, Government Experimental Orchard, Zeerust, and should be crossed National Bank of South Africa.

Orders should be sent to the Government Horticulturist, Agricultural Department, Pretoria, to arrive on 15th May, and *no order will be booked before that date.* They will be duly acknowledged and, where possible, accepted, and a notification sent as to the nursery from which the trees will be despatched. Orders will be taken strictly in rotation, and bona fide farmers will be given preference.

No guarantee is given that all orders received can be executed.

Delivery will take place during July.

Apricots.

20 Blenheim.	20 Royal.

Peaches.

70 Florida Crawford.	80 Brook.
59 Pallas.	24 George.
69 Waldo.	39 Angel
69 Peento.	24 Dr. Hogg.

The above are grown at Zeerust and are suitable for bushveld and low veld.

Apples.

200 Rome Beauty.	181 Lady's Finger.
129 Jonathan.	199 Prince Alfred.
27 Ribston.	40 Adams Pearmain.
97 Dumelow's Seedling.	77 Sturmer Pippin
123 Ribston Pippin.	74 Worcester Pearmain
72 Nickajack.	131 Ohinemuri.
90 Scarlet Nonpareil.	80 Ben Davis.
106 Stirling Castle.	49 Lady Carrington.
54 Cox's Orange Pippin.	27 Climax
29 Stone Pippin	122 Wemmers Hoek.
70 Keswick Codling.	134 Reinette de Canada.
78 Beauty of Bath	19 Boston Russet
59 White Winter Pearmain.	88 Tulis.
48 Cleopatra.	52 Cliff's Seedling

53 Watsonville Special.

Plums.

114 Prune d'Agen.	90 Wickson.
36 Red Nagate.	20 Red June.
85 Yosobe	10 Abundance.
77 Shiro Smomo.	71 October Purple.
30 Chalcot.	85 Ura Bene.
54 Simoni.	40 Ogon Nagate
42 Kelsey.	60 Kerr.
35 Ogon.	38 Hantankio Maru.
32 Hale	13 Hantankio.
51 Apple.	62 Royal.

Peaches

55 Oriole.	24 Elberta.

6 Goldmine Nectarine.

The above are grown at Potchefstroom.

Tobacco Division.

NOTICE TO TOBACCO PLANTERS.

It is hereby notified for the information of tobacco planters that the Tobacco Division, Transvaal Department of Agriculture, is prepared to carry out the sorting, treatment, and baling of tobaccos in their tobacco rooms recently fixed up at their premises, 434 Market Street, Pretoria.

Only lots of from 1,000 to 5,000 lbs. each will be accepted. The planter must bear the cost of carriage to Pretoria, and, in addition, for the handling a small rate per lb. will be charged by the Division to defray working expenses.

For further information, write to—

J. van Leenhoff.
Chief of Tobacco Division,
P.O. Box 434, Pretoria.

Poultry Division.

STOCK BIRDS FOR SALE.

A large number of young stock of the following breeds are for disposal :—
Anconas, pullets, 12s. 6d. and 15s. each , cockerels, 7s. 6d. to 10s. each.
Brown Leghorns, cockerels and pullets, 10s. to 12s. 6d. each.
White Leghorns, cockerels (pullets not yet ready), 10s. to 15s. each.
Black Leghorns, cockerels, 10s. to 15s. each.
Minorcas, cockerels and pullets, 15s. each.
Buff Orpingtons, pullets, 10s. to 15s. each , cockerels 7s. 6d. and 10s. each.
White Wyandottes, cockerels and pullets, 12s. 6d. to 15s. each.

All prices f.o.r. Potchefstroom.

Young Pekin ducks and drakes available 1st March, price 12s. 6d. to 15s. each.

Breeding pens will be mated during April, and settings of fowls' eggs will be available by the end of May price 11s. per setting.

For further particulars and information apply

R. BOURLAY, GOVERNMENT POULTRY EXPERT,
Experimental Farm, Potchefstroom.

Editorial Division.

AVAILABLE PUBLICATIONS.

The following publications can be had, free of charge, on application to the Government Printer, Box 373, Pretoria :—

Transvaal Agricultural Journal, No. 3. Vol. I (Published quarterly.)
" " " No. 13, Vol. IV " "
" " " No. 14, Vol. IV " "
" " " No. 15, Vol. IV " "
" " " No. 16, Vol. IV " "
" " " No. 26, Vol. VII " "

Division of Botany :—
Leaflet No. 1.—" Plants Poisonous to Stock."
" No. 4.—" The Cockle-Bur."
" No. 6.—" Peach Leaf Curl."
Bulletin No. 2.—" The Conditions of Seed and Plant Distribution," 1907-08.
Circular No. 1.—" Poisonous Plants."

Division of Entomology :—
Leaflet No. 1.—" Cut Worms."
" No. 5.—" The Fowl Tick."
" No. 6.—" Cockchafers and Flower Beetles."
" No. 7.—" Sprays for Locust Destruction."
" No. 10.—" Notes on Termites."
" No. 11.—" The Scale Insects of Citrus Trees."

Division of Forestry :—
" Price List of Seeds and Trees."

Division of Horticulture :—
Bulletin No. 1.—" Some Information about Fruit Trees."
Leaflet No. 3.—" A Fruit Report."
" No. 4.—" Diseases of Orange Trees."

Division of Dairying :—
Circular No. 4.—" Treatment of Milk."

Division of Veterinary Science :—
Bulletin No. 1.—" Measles in Swine and Cattle."
" No. 6.—" Contagious Abortion."
Leaflet No. 3.—" Rhodesian Tick Fever."
" No. 5.—" Glanders and Farcy."
" No. 4.—" Directions for Preparing Blood Smears."
" No. 6.—" Wire Worms."

Division of Publications :—
Bulletin No. 1.—" Burweed or Boete Bosch."
" No. 2.—" Some Diseases of the Horse."
" No. 3.—" The Food of Plants."
" No. 6.—" City and Town Milk Supply and the Care and Aeration of Milk."

Farmers' Bulletins :—

Farmers' Bulletin No. 1.—"Maize Foods for the Home."
" " No. 2.—"Notes on Tobacco."
" " No. 3.—"Notes on Lucerne Growing."
" " No. 4.—"Smut in Wheat, Barley, and Oats."
" " No. 5.—"Insect Enemies of Mealies in the Transvaal."
" " No. 6.—"How to secure Good Seed Maize."
" " No. 8.—"Propagation of Trees from Seed."
" " No. 9.—"Notes on Transvaal Tobacco Pests."
" " No. 10.—"How to Produce Bright Tobaccos."
" " No. 11.—"Potato Scab."
" " No. 12.—"Black Rust on the Grape."
" " No. 13.—"Budding and Grafting."
" " No. 14.—"Modern Creamery Methods."
" " No. 16.—"Meaning and Value of Analysis of Soils."
" " No. 17.—"Brands Directory," 1907.
" " No. 18.—"Judging of Butter and Cheese."
" " No. 21.—"A Butter Dairy."
" " No. 22.—"Campbell System of Dry Land Farming."
" " No. 23.—"Citrus Fruit Rot."
" " No. 24.—"Potato Rot."
" " No. 25.—"New York Apple Tree Canker."
" " No. 26.—"Inoculation of Sheep against Blue Tongue."
" " No. 29.—"A Small Cheese Dairy."
" " No. 33.—"The Adams Agricultural Act."
" " No. 34.—"The Pasteurization of Small Quantities of Milk and Cream in Bottles."
" " No. 36.—"Butter-making."
" " No. 37.—"Sweet Milk Cheese-making."
" " No. 38.—"Rules for Butter-making."
" " No. 40.—"Agricultural Education in America."
" " No. 41.—"The Making of Edam Cheese."
" " No. 42.—"The Principle of the Milk Refrigerator."
" " No. 43.—"The Making and Storing of Ice."
" " No. 44.—"Charcoal Making."
" " No. 45.—"The Meaning and Scope of Household Science."
" " No. 46.—"Prevention of Bloat from Pasturing Lucerne."
" " No. 47.—"Ramie Cultivation."
" " No. 48.—"Cotton Cultivation."
" " No. 49.—"The Downy Mildew of the Grape."
" " No. 50.—"The Powdery Mildew of the Grape."
" " No. 51.—"Simple Medicines for the Farm."
" " No. 52.—"Conservation of Soil Moisture."
" " No. 54.—"Four Noxious Weeds."
" " No. 55.—"The Improvement of the Maize Crop."

Miscellaneous :—

Bulletin No. 3.—"The Brands Directory, 1906."
Annual Report of the Director of Agriculture for the year 1903-04
" " " " " 1904-05.
" " " " " 1905-06.
" " " " " 1907-08.

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JOURNAL DUPLICATES.

Any readers who possess and can spare duplicates of the *Agricultural Journal* would confer a great favour by returning them to the Department of Agriculture, as back numbers are now out of print, and applications are constantly being made by persons desirous of completing their sets.

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APPLICATIONS FOR THE *JOURNAL* AND NON-DELIVERY.

Applications to be placed on the Mailing List of the *Journal*, as well as complaints as to non-delivery of the *Journal*, should be addressed to the Government Printer, P.O. Box 373, Pretoria and *not to the Editor of the Journal.* It is particularly requested that changes of address should also be promptly notified to the Government Printer, in order to ensure prompt delivery to addressees and to avoid unnecessary correspondence.

The Transvaal Agricultural Journal is issued free to residents in the Transvaal only.

Persons residing in the other South African Colonies or Oversea may become subscribers by paying an annual subscription of 7s., post free, starting from July in each year: 2s. extra is required for postage oversea.

Subscriptions are payable strictly in advance, and should be made by bank draft, money order, bank notes, or coin. Cheques cannot be accepted in payment, unless initialled by the Bank authorities.

All correspondence must be addressed and payments made to the Government Printer, Box 373, Pretoria.

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LIST OF AGRICULTURAL SOCIETIES.

Barberton	J. S. Dyce, Box 5, Barberton.
Belfast	I. F. Vermooten, Box 18, Belfast.
Bethal	Bergh and Croeser, Box 3, Bethal.
Carolina	John Little, jun., Box 25, Carolina.
Ermelo	S. P. Bekker, Box 72, Ermelo.
Heidelberg	W. Harvey, Box 36, Heidelberg.
Klerksdorp	H. Bramley, Box 56, Klerksdorp
Lydenburg	N. Lombard and M. de Souza, Box 77, Lydenburg.
Marico	S. J. van der Spuy, Box 83, Zeerust.
Middelburg	J. W. Henwood, Box 229, Middelburg.
Potchefstroom	Joubert Reitz, Box 152, Potchefstroom.
Pretoria	M. Lochhead, Box 134, Pretoria.
Standerton	J. J. Bosman, Box 26, Standerton.
Wakkerstroom	G. Maasdorp, Box 87, Volksrust.
Waterberg	J. von Backstrom, Box 7, Nylstroom.
Witwatersrand	W. H. Poultney, Box 4344, Johannesburg.
Wolmaransstad	W. W. de Greef, Box 10, Wolmaransstad.
Zoutpansberg	J. W. Johnson, Box 32, Pietersburg.

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LIST OF FARMERS ASSOCIATIONS.

Aapjes River Ward	F. N. Carlisle, Pyramid Station, Pretoria.
Barberton	W. A. Gregory, Box 52, Barberton.
Crocodile River	E. G. D. Paggenpoel, P.O. Rietfontein West.
Eastern Transvaal	Secretary, Box 76, Springs.
Groot Spelonken	J. W. Walton, Private Bag, Middagzon, via Pietersburg.
Leeuwdoorns	W. H. Pilkington, Baviaans Poort, Leeuwdoorns.
Low Country	A. W. Gale, Middelrand, P.O. Devils Kloof, Zoutpansberg.
Maquassi	E. J. Brown, Maquassi Station.
New Agatha	A. W. Molyneux, Mashutiesberg, via Pietersburg.
Platrand	A. H. Barron, Platrand Station.
Piet Retief	K. P. van Dijk, Box 18, Piet Retief.
Potgietersrust	H. J. Strobel, Box 33, Potgietersrust.
Pretoria Dairy	J. W. Shackell, Box 479, Pretoria.
Pretoria Poultry Club	Matt. Lochhead, Box 1129, Pretoria.
Southern Waterberg	J. A. Manson, Illawarra, P.O. Settlers.
Transvaal	E. W. Hunt, Box 3785, Johannesburg.
Transvaal Settlers	Secretary, Kroomdraai Station.
Transvaal Stock Breeders	F. T. Nicholson, Box 134, Pretoria.
Transvaal Land Owners	H. A. Baily, Box 1281, Johannesburg.
Transvaal Con. Land Co.	C. A. Madge, Box 4303, Johannesburg.
Trichardts	Thos. O. Laing, P.O. Trichardts, via Germiston.
Witwatersrand	H. J. A. Wentworth, P.O. Craighall, near Johannesburg.
Witwatersrand Dairy	Alex. Sloan, Box 5908, Johannesburg.
White River	Edmond M. Dwyer, P.O. White River, via Nelspruit.
Wolmaransstad	Secretary, Wolmaransstad.

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OTHER SOCIETIES.

South African Bee Keepers' Association	Hon. Secretary and Treasurer, "C.S.A.R. Headquarters, Johannesburg"; Senior Bee Expert, F. Sworder.
Magaliesberg Fruit Growers' Association	J. C. P. Maynard, Hon. Sec., P.O. Wolhuterskop, via Pretoria.

OTHER COLONIES.

Agricultural Union of Cape Colony, D. M. Brown, Box 187. Port Elizabeth.
Bloemfontein and O.R.C. Agricultural Society, J. Fraser, Box 250, Bloemfontein.
Cape Central Farmers' Association, H. C. Hall, Bedford, Cape Colony.
Cape Stud Breeders' Association, J. Pike, Box 703, Capetown.
Natal Agricultural Union, D. M. Eadie, Timber Street, Pietermaritzburg.
Orange River Colony Central Farmers' Association, W. B. Fowler, Secretary, Hill's Buildings, Maitland Street, Bloemfontein.
Orange River Colony Stockbreeders' Association, Secretary, Bloemfontein.
Rhodesian Agricultural Union, Secretary, Box 135, Salisbury. Rhodesia.
South African Co-operative Union, A. C. Lyell, Box 574. Bloemfontein, O.R.C.
Upper Klip River Farmers' Association, Secretary, Vrede District, O.R.C.

In view of the fact that several errors have been detected in the List of Farmers Associations and Agricultural Societies in the Transvaal, we propose to publish a revised list, and shall be glad if all secretaries of associations and societies which have been omitted will kindly communicate with the Editor.

LIST OF OFFICIALS.

The following is a list of the officials of the Transvaal Department of Agriculture, to whom enquiries respecting matters connected with agriculture may be addressed:—

The Right Hon. the Minister of Agriculture....	General Louis Botha.
Director of Agriculture	F. B. Smith.
Government Veterinary Bacteriologist...........	Dr. A. Theiler.
Principal Veterinary Surgeon..	C. E. Gray.
Acting Chief Chemist..................................	R. D. Watt.
Agrostologist and Botanist............................	J. Burtt-Davy.
Plant Pathologist..	I. B. Pole Evans.
Conservator of Forests................................	C. E. Legat.
Acting Entomologist....................................	D. G. Gunn.
Horticulturist...	R. A. Davis.
Chief of Tobacco Division.............................	J. van Leenhoff.
Superintendent of Co-operation......................	B. Stilling-Andersen.
Superintendent of Dairying............................	Robert Pape.
Agricultural Statistician................................	G. F. Joubert.
Editor, *Agricultural Journal*, and Dry-Land Agronomist.........	William Macdonald.
Poultry Expert, Government Experimental Farm, Potchefstroom	R. Bourlay.
General Manager, Government Experimental Farm, Potchefstroom	Alexander Holm.
General Manager, Government Stud Farm, Standerton.	A. McNae.
Flock-master and Wool Expert..........................	V. Bossley.
Acting Manager, Government Experimental Farm, Tzaneen. .. .	Walter H. Charter.
Registrar of Brands and Controller of Fencing....	J. J. Pienaar.
Government Inspector of Produce for Export	F. P. Jacobsz.
Chief Clerk..	B. Enslin.
Accountant..	A. J. Firth.
Translator...	Otto Menzel.
Librarian..	J. C. Goldman.

ADDRESS.

Correspondents are earnestly requested to give their full name and correct postal address when forwarding any communication to the Department. It sometimes happens that readers send their farm address only, and fail to give the Post Office address, consequently it is impossible to reply to their queries or send publications. This refers more especially to farmers applying for cattle permits, as in many cases letters forwarded by the Veterinary Division are returned by the Postal Authorities to the effect "Not delivered, Address insufficient." The Department should also be immediately notified of any change of address.

* * * *

SOUTH AFRICAN STUD BOOK.

A record of all classes of stock, the object being to encourage the breeding of thoroughbred stock and to maintain the purity of breeds, thus enhancing their value to the individual owner and to the country generally.

Application for membership and entries of stock should be addressed to—
For Cape Colony—A. A. Persse, P.O Box 703, Capetown.
For Transvaal—F. T. Nicholson, P.O. Box 134, Pretoria.
For Orange River Colony—E. J. MacMillan, Government Buildings, Bloemfontein.

The South African Stud Book, Volume I, is obtainable from T. Maskew Miller, Adderley Street, Capetown. Price, 10s. 6d.

A. A. PERSSE, *Secretary*,
South African Stud Book Association.

CONDITIONS OF BONDS AT THE TRANSVAAL LAND AND AGRICULTURAL BANK.

1. That the mortgagor will pay the principal sum mentioned in the mortgage with interest thereon in accordance with the provisions of the Land and Agricultural Bank Act, 1907, as amended by the Land and Agricultural Bank Amendment Act, 1908, and at the due dates thereof.

2. That the mortgagor will from time to time so long as money remains owing on this security, well and substantially repair and keep in good and substantial repair and condition all buildings or other improvements erected and made upon the said land, and the Bank may at all times be at liberty by itself, its agents, or servants to enter upon the said land to view and inspect the said buildings and improvements.

3. That if the mortgagor fails or neglects to repair the said buildings and improvements or to keep them in good and substantial repair and condition as aforesaid, then and in any such case and as often as the same shall happen it shall be lawful for but not obligatory upon the Bank, at the cost and expense in all things of the mortgagor, to repair the said buildings and improvements and keep them in good and substantial repair and condition.

4. That all moneys expended by the Bank in and about in repairing or keeping in repair any of the said buildings and improvements as aforesaid or in attempting to exercise or enforce any power, right, or remedy herein contained or implied in favour of the Bank shall be payable to the Bank by the mortgagor on demand, and until paid shall be charged on the said land, together with the interest thereon at the rate of not more than six per centum per annum computed from the date or dates of such moneys being expended.

5. Insurance shall be effected as may be prescribed by regulation or instruction of the Board. Every policy of insurance so effected shall be ceded to the Bank as collateral security.

6. That the power of sale and incidental powers in that behalf conferred upon the Bank under section *thirty-three* of the Land and Agricultural Bank Act, 1907, amended as aforesaid, shall be implied herein and that they may be exercised without any notice or demand whatsoever if and whenever the mortgagor makes default for three months in the full and punctual payment of any instalment of interest or principal in accordance with the respective covenants for the payment thereof herein contained or if and whenever the mortgagor makes default in the faithful observance and performance of any other covenant or condition on his part herein contained or implied.

7. That if and whenever the mortgagor makes any such default as in the last preceding covenant mentioned it shall be lawful for the Bank to call up and compel payment of all principal, interest, and other moneys for the time being owing under this security, notwithstanding that the time or times hereinbefore appointed for the payment thereof respectively may not have arrived.

8. That the mortgagor will at all times cultivate and manage the mortgaged land in a skilful and proper manner and according to the rules of good husbandry. Failure in the performance of this condition shall entail the immediate recovery of the loan should the Bank so desire. This section shall, however, not apply to a farm mortgaged as security and used exclusively for stock farming.

9. That this mortgage is subject to all the provisions of the Land and Agricultural Bank Act, 1907, amended as aforesaid, relating to mortgages under those Acts.

TRANSVAAL LAND AND AGRICULTURAL BANK, PRETORIA.

TABLE OF PRESCRIBED HALF-YEARLY INSTALMENTS

Payable in Advance for every £100 (One Hundred Pounds) of the Loan, at Seven Pounds per centum, namely, Five Pounds per centum for interest, and the balance in reduction of the capital, such half-yearly payments beginning at first half-year.

Half-Year.	Prescribed Half-Yearly Instalments.	Apportioned thus: On Account of Interest at 5 per cent.	Apportioned thus: On Account of Principal.	Balance of Principal.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1st	3 10 0	2 10 0	1 0 0	99 0 0
2nd	3 10 0	2 9 8	1 0 4	97 19 8
3rd	3 10 0	2 9 0	1 1 0	96 18 8
4th	3 10 0	2 8 4	1 1 8	95 17 0
5th	3 10 0	2 8 0	1 2 0	94 15 0
6th	3 10 0	2 7 4	1 2 8	93 12 4
7th	3 10 0	2 6 8	1 3 4	92 9 0
8th	3 10 0	2 6 4	1 3 8	91 5 4
9th	3 10 0	2 5 8	1 4 4	90 1 0
10th	3 10 0	2 5 0	1 5 0	88 16 0
11th	3 10 0	2 4 4	1 5 8	87 10 4
12th	3 10 0	2 3 8	1 6 4	86 4 0
13th	3 10 0	2 3 0	1 7 0	84 17 0
14th	3 10 0	2 2 8	1 7 4	83 9 8
15th	3 10 0	2 1 8	1 8 4	82 1 4
16th	3 10 0	2 1 0	1 9 0	80 12 4
17th	3 10 0	2 0 4	1 9 8	79 2 8
18th	3 10 0	1 19 8	1 10 4	77 12 4
19th	3 10 0	1 18 8	1 11 4	76 1 0
20th	3 10 0	1 18 0	1 12 0	74 9 0
21st	3 10 0	1 17 4	1 12 8	72 16 4
22nd	3 10 0	1 16 4	1 13 8	71 2 8
23rd	3 10 0	1 15 8	1 14 4	69 8 4
24th	3 10 0	1 14 8	1 15 4	67 13 0
25th	3 10 0	1 14 0	1 16 0	65 17 0
26th	3 10 0	1 13 0	1 17 0	64 0 0
27th	3 10 0	1 12 0	1 18 0	62 2 0
28th	3 10 0	1 11 0	1 19 0	60 3 0
29th	3 10 0	1 10 0	2 0 0	58 3 0
30th	3 10 0	1 9 0	2 1 0	56 2 0
31st	3 10 0	1 8 0	2 2 0	54 0 0
32nd	3 10 0	1 7 0	2 3 0	51 17 0
33rd	3 10 0	1 6 0	2 4 0	49 13 0
34th	3 10 0	1 5 0	2 5 0	47 8 0
35th	3 10 0	1 3 8	2 6 4	45 1 8
36th	3 10 0	1 2 8	2 7 4	42 14 4
37th	3 10 0	1 1 4	2 8 8	40 5 8
38th	3 10 0	1 0 0	2 10 0	37 15 8
39th	3 10 0	0 19 0	2 11 0	35 4 8
40th	3 10 0	0 17 8	2 12 4	32 12 4
41st	3 10 0	0 16 4	2 13 8	29 18 8
42nd	3 10 0	0 15 0	2 15 0	27 3 8
43rd	3 10 0	0 13 8	2 16 4	24 7 4
44th	3 10 0	0 12 0	2 18 0	21 9 4
45th	3 10 0	0 10 8	2 19 4	18 10 0
46th	3 10 0	0 9 4	3 0 8	15 9 4
47th	3 10 0	0 7 8	3 2 4	12 7 0
48th	3 10 0	0 6 0	3 4 0	9 3 0
49th	3 10 0	0 4 8	3 5 4	5 17 8
50th	6 0 8	0 3 0	5 17 8	—

GOVERNMENT NOTICE No. 957 OF 1908.

IMMUNIZATION OF MULES.

It is hereby notified for general information that the Government Veterinary Surgeons are now prepared to undertake the immunization of mules against horse-sickness, in the districts in which veterinary surgeons are stationed, at the undermentioned reduced rates and subject to the following conditions:—

(a) *With Insurance:* On payment of a fee of £1 per head for each mule immunized, the Government undertakes to pay in compensation for any animal dying as a result of inoculation whilst under treatment, according to a valuation fixed by the Government Veterinary Surgeon, an amount not exceeding £15 per animal; provided the Government Veterinary Surgeon certifies that the conditions imposed by him have been duly complied with.

(b) *Without Insurance:* On payment of a fee of 10s. per animal, provided the owner signs a declaration to the effect that he understands clearly that, by availing himself of the reduced fee for inoculation, he forfeits any right which he may have to compensation in the event of any mule dying after inoculation, and that the Government gives no guarantee regarding the immunity of the animals inoculated.

Any animal intended for inoculation may, at the discretion of the Government Veterinary Surgeon, be tested with mallein before being inoculated against horse-sickness.

Any owner of mules desirous of having them inoculated is requested to make early application to the Government Veterinary Surgeon of his district.

Government Notice No. 1014 of 1905 shall be and is hereby withdrawn.

C. E. GRAY,
Acting Director of Agriculture.

Department of Agriculture,
Pretoria, 22nd September, 1908.

LIST OF ADDRESSES OF FIELD CORNETS.

PIET RETIEF.

Piet Retief	Jan Christoffel Greyling Kemp, P.O. Box 10, Piet Retief.
Assegaairivier	Heinrich Martin Friedrich Meyer, P.O. Bergen.

WAKKERSTROOM.

Wakkerstroom	Izaak Johannes Greyling, Hangkloof, P.O. Wachteenbeetje, Wakkerstroom.
Amersfoort	Gabriel Michael Carel Swart, Vaalbank, Amersfoort.
Volksrust	Christian Burger Pringle, P.O. Volksrust.

STANDERTON.

Blesbokspruit	Hendrik Johannes Janse van Vuren, Rietvlei, P.O. Blesbokspruit.
Waterval	Johannes Joachim Alberts, Klipdrift, P.O. Val Station.
Kliprivier	Coenraad Jacobus Brits, Leeuwkraal, P.O. Platrand Stn.
Steenkoolspruit	Adam Gilfillan, Dorstfontein, P.O. Onverwacht, Bethal.
Bethal	Petrus Johannes Dirk Erasmus, Groenpunt, P.O. Box 63, Bethal.

ERMELO.

Ermelo	Abraham Gerhardus Kleynhans, Vleiplaats, P.O. Brakfontein.
Amsterdam	Johannes Nicholaas Hermanus Grobler, P.O. Bankkop.
Chrissiemeer	Barend Jacobus Johannes Smit, P.O. Box 56, Ermelo.

CAROLINA.

Carolina	Johannes Hieronimus Brink, P.O. Box 37, Carolina.
Theespruit	Willem Hendrik de Villiers, P.O. Box 21, Carolina.
Komatirivcr	Johannes Lodewikus Grobler, Drenthe, P.O. Bonnefoi Stn.

BARBERTON.

Barberton	Hendrik Thomas Watkins, P.O. Barberton.
Witrivier	Paul Michael Marits, Kaapsche Hoop.

LYDENBURG.

Steelpoort	Jacobus Nieuwenhuize, Rietfontein, P.O. Boschfontein.
Ohrigstad	Pieter Barend Swart, Uitkomst, P.O. Rustplaats.
Krokodil	David Johannes Schoeman, P.O. Rietfontein, Lydenburg.
Steenkampsberg	Christiaan Cornelius Cloete Joubert, P.O. Dullstroom.

MIDDELBURG.

Olifantsrivier	Gerhardus Wilhelmus van Niekerk, Goedehoop, P.O. Vaalkrants.
Steenkoolspruit .. .	Joachim Johannes Cornelis van Niekerk, Doornrug, P.O. Balmoral.
Mapochsgronden . ..	Adam Johannes Willemse, P.O. Tonteldoos.
Selonsrivier	Josias Servaas de Kock, P.O. Box 3, Middelburg.
Secocoeniland	Christian Ernst Schutte, Rietfontein, P.O. Pokwani.

ZOUTPANSBERG.

Mara (Noord)	Marthinus Johannes Petrus Biermann, Bergplaats, P.O. Mara.
Rhenosterpoort . ..	Andries Stephanus David Erasmus, Smitsplaats, P.O. Pietersburg.
Marabastad	Christoffel Hofmeyr, P.O. Marabastad.
Olifants	Ernst Lodewikus Marais, De Diepte, P.O Chunespoort.
Groot Spelonken .. .	Johannes Frederik Lodewikus Janse van Rensburg, Rustfontein, P.O. Buffels.
Klein Spelonken . ..	Pieter Willem Möller, Groblerplaats, P.O. Louis Trichardt.
Houtbosch	Austin Welsh Wienand, Laatstehoop, P.O. Smitsdrift.
Lageveld, Klein Letaba .	Jacobus Cornelis Boltman, Korthanie, P.O. Duivelskloof

PRETORIA.

Krokodilrivier	Marthinus Nicholaas Rickert, Hartebeestpoort, P.O. Rietfontein West.
Witwatersrand . .	John Geo. Jones, P.O. Hennopsrivier.
Bronkhorstspruit	Jacobus van der Walt, Knoppiesfontein, P.O. Bapsfontein, Kaalfontein Station.
Elandsrivier	Pieter Lafras Uys, Rietfontein, Bronkhorstspruit Station.
Aapiesrivier	Johannis Barend Wolmarans, Donkerhoek, P.O. Hatherley.

RUSTENBURG.

Hexrivier	Georg Heinrich Wilhelm Behrens, P.O. Bethanie.
Elandsrivier	Roelof Jacobus Petrus van Tonder, Rietfontein, P.O. Brakkloof, Marico Station.
Hoogveld	Pieter Stephanus Steenekamp, P.O. Cijferbult.
Zwartruggens . ..	Petrus Jacobus van der Walt, Witrand, P.O. Koster.

HEIDELBERG.

Roodekoppen	Andries Jacobus Greyling, Roodewal, P.O. Greylingstad Station.
Hoogveld	Willem Francois Pretorius, Rietfontein, P.O. Devon Station, via Springs.
Suikerboschrand	Johannes Stephanus Fourie, Boschfontein, P.O. Heidelberg.
Kliprivier	William George Devenish, Witkoppies, P.O. Meyerton.

KRUGERSDORP.

Krugersdorp	Nicholaas Jacobus Pretorius, jun., Hartebeesthoek, P.O. Scheerpoort, Pretoria.
Witwatersberg	Frederik Jacobus Potgieter, Nooitgedacht, P.O. Hekpoort.
West Rand	Christoffel Frederik Theodorus Hendrikz, Luipaardsvlei, P.O. Randfontein.

POTCHEFSTROOM.

Boven Mooirivier	Stephanus Gottfried Kriegler, P.O. Frederikstad.
Gatsrand	Jacobus Francois van der Merwe, Leeuwkop, P.O. Kraalkop.
Vaalrivier	Nicholaas Marthinus Prinsloo, Modderfontein, P.O. Lindequesdrift.
Boven Schoonspruit	Daniel Johannes Ysel, Elandskuil, P.O. Ventersdorp.
Onder Schoonspruit	Pieter Jacobus Jooste, P.O. Box 5, Hartebeestfontein.

MARICO.

Boschveld	Francois Johannes Diederik Furstenburg, Witpoortje, Zeerust.
Klein Marico	Daniel Lourens Botha, Weltevreden, P.O. Box 97, Zeerust.
Groot Marico	Lourens van Niekerk, Doornkraal, P.O. Wonderfontein.
Hoogveld	Willem Adriaan Lombaard, Rietspruit, P.O. Grootafdeeling.
Moloppo	Charles Pieter Marais, P.O. Ottoshoop.

LICHTENBURG.

Zoutpan	Andries Petrus Visser, Leeuwpan, P.O. Barberspan.
Lager Hartsrivier .. .	Jan Hendrik Petrus van der Merwe, Boschpoort, P.O. Kohannafontein.
Boven Hartsrivier .	Gabriel Johannes Greeff, P.O. Manana.

BLOEMHOF.

Schweizer Reneke	Louis Elwin Lauritz Mussmann, P.O. Schweizer Reneke.
Christiana	Paul Johannes Marc, Grootplaats, P.O. Christiana.
Bloemhof	Pieter de la Rey Swartz, Vuurfontein, P.O. Bloemhof.

WOLMARANSSTAD.

Boven Wijk	Wouter Cornelis Justinus Brink, Vlakfontein, P.O. Witfontein.
Onder Wijk	Sarel Petrus du Toit, Wildebeestkantoor, P.O. Leeuwdoorns.

WATERBERG.

Koedoesrand and Zoutpan .	Marthinus Phillippus van Staden, Hoornbosch, P.O. Oranjefontein.
Zwagershoek	Christoffel Bernardus Swanepoel, Knopfontein, P.O. Alma.
Nijlstroom	Hermanus Stephanus Lombard, Grootvlei, P.O. Box 21, Nijlstroom.
Potgieters	Daniel Petrus van Rooyen, P.O. Potgietersrust.

Annual Sale of Government Stock, held at the Potchefstroom Experimental Farm, 28th November, 1908.

List of Purchasers, with Addresses.

Purchasers.	Stock Purchased.		Price.	Total.
			£ s. d.	£ s. d.
J. de Braal, Pretoria ..	Shorthorn bull ..	D.O.A. 9 E.	40 19 0	
	Suffolk ram	D.O.A. 79 P.	11 11 0	
	Berkshire boar ..	D.O.A. 29 P.	2 12 6	
				55 2 6
Mr. Beverley, Zeerust ..	Shorthorn bull .	D.O.A. 15 P.	47 5 0	
				47 5 0
A. E. Brambley, Moorbank, Potchefstroom	Berkshire boar .	D.O.A. 37 P.	3 3 0	
	Ayrshire bull ..	D.O.A. 20 P.	38 17 0	
				42 0 0
Capt. Battine, Harrisburg Station	Hereford bull ..	D.O.A. 18 P.	31 10 0	
				31 10 0
Jas. F. Bell, Kinross, via Springs	Aberdeen-Angus bull	D.O.A. 11 P.	56 14 0	
	Large black sow ..	D.O.A. 138 P.	3 3 0	
				59 17 0
P. Blackmore, Plantation Farm, Barberton	Berkshire boar ..	D.O.A. 27 P.	5 5 0	
				5 5 0
G. R. Brindley, Box 4245, Johannesburg	Berkshire boar ..	D.O.A. 28 P.	4 14 6	
				4 14 6
Jas. Butler, Evaton Station	Large black boar ..	D.O.A. 143 P.	4 14 6	
	Large black sow ..	D.O.A. 135 P.	4 14 6	
	Large white Yorkshire boar	D.O.A. 158 P.	6 16 6	
				16 5 6
N. Corbitt, Potchefstroom	Aberdeen-Angus bull	D.O.A. 9 P.	31 10 0	
				31 10 0
T. Cullen, Dynamite Factory, Modderfontein	Suffolk ram .. .	D.O.A. 75 P.	11 11 0	
	Suffolk ram	D.O.A. 93 P.	11 11 0	
				23 2 0
W. Daly, Zeerust ..	Suffolk ram	D.O.A. 81 P.	9 19 6	
				9 19 6
W. A. Dodds, Box 33, Johannesburg	Suffolk Down ram ..	D.O.A. 90 P.	16 5 6	
				16 5 6
M. Donovan, Box 4, Newclare	Large white Yorkshire boar	D.O.A. 162 P.	4 4 0	
				4 4 0
P. Eglington, P.O. Bankop, Ermelo	Ayrshire bull "New Year" ..		53 11 0	
				53 11 0
	Carried forward		..	£490 11 6

Annual Sale of Government Stock—(*continued*).

Purchasers.	Stock Purchased.		Price. £ s. d.	Total. £ s. d.
	Brought forward ..	..		400 11 6
C. Exter, Potchefstroom	Merino ram ..	.. No. 10 ..	7 7 0	
	Suffolk ram ..	.. D.O.A. 99 P.	11 11 0	18 18 0
H. Emmerick, Welverdiend	Large black sow	.. D.O.A. 142 P.	3 3 0	3 3 0
J. G. Fleming, Iona, Lake Chrissie	Shorthorn bull "Scampton Exciseman"	.. D.O.A. 11 P.	26 5 0	26 5 0
J. W. Glendenning, Pienaar's River	Shorthorn bull	.. D.O.A. 14 P.	53 11 0	
	Large black sow	.. D.O.A. 139 P	3 8 3	
	Large black sow	.. D.O.A. 140 P.	3 3 0	60 2 3
D. C. Greig, Box 1373 Johannesburg	Aberdeen-Angus bull	D.O.A. 8 P	65 2 0	
	Merino ram .	.. No. 9 .	7 7 0	72 9 0
J. Grimbeek, Potchefstroom	Suffolk ram ..	.. D.O.A. 86 P.	8 18 6	8 18 6
J. Herold, Herold Colliery, Fortuna	Shorthorn bull "Alford King"	. D.O.A. 3 P	25 4 0	25 4 0
Hobbs & Bennett, Klip River Station	Shorthorn bull	. D.O.A. 16 P.	42 0 0	
	Large white Yorkshire boar ..	.. D.O.A. 157 P.	5 15 6	47 15 6
Haggett & Ovens, Ventersdorp	Shorthorn bull	.. D.O.A. 18 P	37 16 0	37 16 0
Dr. Hinde, Box 17, Carolina	Ayrshire bull	.. D.O.A. 19 P	48 6 0	48 6 0
Mr Harvey, Heidelberg	Suffolk ram ..	.. D.O.A. 76 P	12 1 6	
	Suffolk ram ..	. D.O.A. 78 P	12 1 6	
	Suffolk ram ..	.. D.O.A. 83 P.	11 11 0	
	Merino ram ..	.. No 5 .	9 9 0	
	Large black sow	. D.O.A. 141 P.	3 3 0	48 6 0
C. Harvey, Potchefstroom	Berkshire sow	.. D.O.A. 32 P.	3 3 0	3 3 0
R. H. & A. Kent, P.O. Barberspan, Lichtenburg	Merino ram ..	.. No. 6 ..	9 9 0	
	Merino ram ..	.. No. 7 ..	9 9 0	
	Merino ram ..	No. 8 ..	8 18 6	27 16 6
W. A. McLaren, Vereeniging	Shorthorn bull	.. D.O.A. 16 P.	59 17 0	
	Sussex bull ..	.. D.O.A. 14 P.	33 12 0	
	Hereford bull	.. D.O.A. 20 P.	78 15 0	172 4 0
	Carried forward ..	..	..	£1,000 18 3

ANNUAL SALE OF GOVERNMENT STOCK—(*continued*).

Purchasers.	Stock Purchased.	Price. £ s. d.	Total. £ s. d.
	Brought forward	..	1,000 18 3
Mr. McGuire, Potgieters rust	Suffolk ram .. .. D.O.A. 82 P.	8 18 6	
	Suffolk ram .. . D.O.A. 85 P.	9 19 6	
			18 18 0
The Hon. J. E. van der Merwe, Potchefstroom	Suffolk ram .. .. D.O.A. 87 P.	9 9 0	
	Suffolk ram .. .. D.O.A. 89 P.	11 11 0	
	Suffolk ram . . D.O.A. 92 P.	13 13 0	
			34 13 0
G. G. Moody, Haaskraal, Potchefstroom	Suffolk ram .. .. D.O.A. 94 P.	9 19 6	
			9 19 6
Mr. Munro, Cleveland..	Berkshire sow .. D.O.A. 33 P.	3 3 0	
			3 3 0
B. Liepman, Box 159, Johannesburg	Berkshire sow .. D.O.A. 35 P.	3 3 0	
	Berkshire sow .. D.O.A. 36 P.	4 14 6	
	Berkshire sow .. D.O.A. 38 P.	3 3 0	
	Large white Yorkshire sow .. .. .. D.O.A. 170 P.	4 4 0	
	Large white Yorkshire sow .. .. .. D.O.A. 172 P.	2 12 6	
	Large white Yorkshire sow .. .. .. D.O.A. 130 P.	11 0 6	
			28 17 6
C. G. Newman, Pretoria Gardens, Pretoria	Large white Yorkshire boar .. .. D.O.A. 161 P.	3 3 0	
			3 3 0
Norman & Boyce, Box 2531, Johannesburg	Large white Yorkshire sow .. . . D.O.A. 8 P.	7 17 6	
			7 17 6
P. J. Potgieter, Dagga Kraal, P.O. Driefontein, via Amersfoort	Shorthorn bull . D.O.A. 8 E.	46 4 0	46 4 0
C. A. Russell, Box 234, Johannesburg	Berkshire boar . D.O.A. 30 P.	5 5 0	
			5 5 0
Mr. Staunton, Ermelo..	Hereford bull . D.O.A. 12 E.	46 4 0	
	Hereford bull .. D.O.A. 13 E.	77 14 0	
			123 18 0
J. Spencer, Devon Station	Suffolk ram .. . D.O.A. 84 P.	8 18 6	
	Suffolk ram .. .. D.O.A. 88 P.	13 2 6	
	Suffolk ram .. . D.O.A. 91 P.	15 15 0	
			37 16 0
L. Bagshawe Smith, Mat jespruit, Harrisburg	Berkshire boar .. D.O.A. 31 P.	5 5 0	
			5 5 0
Vine & Warpole, Bloemhof	Suffolk ram .. .. D.O.A. 80 P.	11 0 6	
	Suffolk ram . .. D.O.A. 95 P.	9 19 6	
	Suffolk ram .. .. D.O.A. 96 P.	9 9 0	
			30 9 0
	Carried forward	..	£1,356 6 9

Annual Sale of Government Stock—(*continued*).

Purchasers.	Stock Purchased.	Price.	Total.
		£ s. d.	£ s. d.
	Brought forward	..	1,356 6 9
S. G. Wilks, c/o A. L. Davison, Holmdene Station	Sussex bull .. .. D.O.A. 15 P.	31 10 0	31 10 0
Wolff & Simpson, Pietersburg	Suffolk ram .. .. D.O.A. 77 P.	11 11 0	
	Large black boar .. D.O.A. 142 P.	8 18 6	20 9 6
South African Wattles, Box 39, Bethal	Berkshire boar .. D.O.A. 32 P	4 14 6	4 14 6
P. S. Patterson, Potchefstroom	Berkshire sow .. D.O.A. 34 P.	3 13 6	3 13 6
			£1,416 14 3
	Poultry Sales		47 2 6
			£1,463 16 9

Cattle.

Breed	No. Sold. Imported	No. Sold. Bred on Farm	Highest Price.	Lowest Price.	Average Price.	Total.
			£ s. d.	£ s. d.	£ s. d.	£ s. d.
Lincoln Red Shorthorn Bulls	2	—	26 5 0	25 4 0	25 14 6	51 9 0
Lincoln Red Shorthorn Bulls	-	6	53 11 0	37 16 0	44 12 6	267 15 0
Shorthorn (Coates) Bull .	—	1	—	—	—	59 17 0
Ayrshire Bulls . .	—	2	48 6 0	38 17 0	43 11 6	87 3 0
Sussex Bulls .. .	-	2	33 12 0	31 10 0	32 11 0	65 2 0
Hereford Bulls	—	4	78 15 0	31 10 0	58 10 9	234 0 0
Aberdeen-Angus Bulls ..	—	3	65 2 0	31 10 0	51 2 0	153 6 0
						£918 15 0

Sheep.

Breed.	No. Sold. Imported.	No. Sold. Bred on Farm.	Highest Price.	Lowest Price.	Average Price.	Total.
			£ s. d.	£ s. d.	£ s. d.	£ s. d.
Suffolk Down Rams ..	23	—	16 5 6	8 18 6	11 6 11	260 18 6
Merino Rambouillet Ram..	1	—	—	—	—	9 9 0
Merino Rambouillet Rams	—	5	9 9 0	7 7 0	8 10 0	42 10 0
						£312 17 6

ANNUAL SALE OF GOVERNMENT STOCK—(*continued*).

PIGS.

Breed.	No. Sold. Imported.	No. Sold. Bred on Farm.	Highest Price.	Lowest Price.	Average Price.	Total.
			£ s. d.	£ s. d.	£ s. d.	£ s. d.
Berkshire (boars and sows)	..	13	5 5 0	2 12 6	3 19 11	51 19 6
Large Black (boars and sows)	-	8	8 18 6	3 3 0	4 5 11	34 7 9
Large White Yorkshire (boars and sows)	—	6	6 16 6	2 12 6	4 7 7	26 5 6
Large White Yorkshire (sows)	2	--	11 0 0	7 17 6	9 9 0	18 18 0
						£131 10 9

SUMMARY.

	Average Price, 1905	Average Price, 1906.	Average Price, 1907.	Average Price, 1908
CATTLE—	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Bulls (imported)	40 13 9	45 13 6	42 0 0	25 14 0
Bulls (bred on farm)	35 7 7	42 11 6	57 10 4	48 3 0
SHEEP—				
Suffolk Down Rams (imported) ..	-	-	—	11 6 11
Rambouillet Merino Rams (bred at Stud Sheep Farm, Ermelo)	-	-	—	8 10 0
Rambouillet Merino Ram (imported)..	-		-	9 9 0
PIGS—				
Boars and Sows (bred on farm) ..	—	4 7 9	3 9 3½	4 3 0
Sows (imported)		-	—	9 9 0

DISTRICT SUMMARY.

District.	Stock Purchased. Bulls	Stock Purchased. Rams	Stock Purchased. Pigs.	Value.
				£ s. d.
Barberton	--	--	1	5 5 0
Bethal	1	-	2	64 11 6
Bloemhof	--	3	--	30 9 0
Carolina	2	—	..	74 11 0
Ermelo	4	1	—	249 18 0
Heidelberg	5	7	5	347 11 0
Klerksdorp	1	—	1	36 15 0
Lichtenburg	—	3	---	27 16 6
Marico	1	1	--	57 4 6
Potchefstroom	2	7	4	155 18 6
Pretoria	2	3	4	141 9 9
Standerton	1	—	—	31 10 0
Ventersdorp	1	—	—	37 16 0
Wakkerstroom	1	—	-	46 4 0
Waterberg	—	2	..	18 18 0
Witwatersrand	—	1	11	70 7 0
Zoutpansberg	--	1	1	20 9 6
		29	29	£1,416 14 3

Transvaal Meteorological Department.

OBSERVATIONS OF TEMPERATURES (FROM SELF-REGISTERING THERMOMETERS IN STEVENSON SCREENS).—NOVEMBER, 1908.

PLACE.	FOR THE MONTH.			HIGHEST.	LOWEST.
	Mean Max.	Mean Min.	Mean.		
	degs.	degs.	degs.	degs.	degs.
Bloemhof	85·6	55·7	70·6	93·0 on 20th	12·0 on 7th
Johannesburg—					
Joubert Park ...	74·6	54·2	64·4	81·5 ,, 14th	44·0 ,, 1st
Observatory ...	72·6	53·8	63·2	76·9 ,, 12th & 22nd	44·6 ,, 1st
Komatipoort	89·5	66·6	78·0	102·0 ,, 13th	59·0 ,, 1st
Pietersburg	80·2	58·8	69·5	87·5 ,, 21st	52·0 ,, 8th
Pretoria, Agricultural Chemical Laboratory ..	85·1	61·7	73·6	91·0 ,, 22nd	54·5 ,, 2nd
Volksrust	71·7	50·3	61·0	80·0 ,, 25th	44·0 ,, 22nd
Zeerust	85·7	58·9	72·3	93·9 ,, 13th	42·0 ,, 1st

The temperatures for November, 1908, compare evenly with those of November, 1907, and are normal for the month.

RAINFALL RETURN FOR NOVEMBER, 1908.

(Including Rainfall since 1st July last and the corresponding figures for previous season.)

NOTE.—The rainy season is measured from 1st July in one year to the 30th June in the next.

DISTRICT	PLACE	MONTH.		SEASON.		AVERAGES.			
		Nov., 1908.		From 1st July, 1908.		Month.		Season.	
		Ins.	Days.	Ins.	Days.	Ins.	Days.	Ins.	Days.
Barberton ...	Barberton	4·38	19	9·63	17	4·96	11	8·30	30
	Komatipoort	3·78	9	6·96	19	2·99	10	5·94	20
Bethal ...	Bethal	4·80	15	10·50	34	4·70	14	8·83	27
Bloemhof ...	Bloemhof	1·85	8	6·02	25	2·42	9	4·99	20
Carolina ...	Carolina	6·10	11	9·58	28	5·81	-	9·71	—
Ermelo ...	Ermelo	4·81	15	11·28	34	- -			-
Heidelberg ...	Heidelberg	5·51	16	9·26	36	5·13	12	8·64	27
Lydenburg ...	Pilgrims Rest	7·45	16	11·43	43	4·92	15	8·24	37
Marico ...	Zeerust	2·49	13	6·97	28	3·93	9	6·54	20
Middelburg ...	Middelburg	6·53	15	9·71	29	6·11	14	9·41	27
Piet Retief	Piet Retief	5·14	17	11·73	44	6·24	16	12·14	—
Potchefstroom	Klerksdorp	2·81	9	8·66	25	2·55	9	5·62	23
	Potchefstroom	3·75	10	8·50	27	3·68	9	6·55	24
Pretoria ...	Arcadia, Pretoria ...	2·92	13	7·81	27	5·15	14	8·07	25
	Modderfontein	3·00	13	9·14	30	4·34	12	7·06	24
Rustenburg ...	Rustenburg	1·72	10	8·16	24		--	—	—
Standerton ...	Standerton	5·59	18	11·57	39	-	—	—	-
Swaziland ...	Mbabane	7·87	22	16·52	68	6·87	19	13·02	46
Wakkerstroom	Volksrust	6·26	16	15·21	38	5·97	13	10·16	31
Witwatersrand	Joubert Park, J'burg ...	3·83	15	10·09	36	5·64	14	9·29	29
	Govt. Observatory, J'burg	3·45	14	9·33	32	4·79	12	8·56	26
	Krugersdorp	3·10	14	8·59	29	4·06	12	6·85	24
Zoutpansberg	Pietersburg	3·91	12	5·62	22	2·67	9	4·82	16
	Leydsdorp	5·61	14	7·90	25	—	---	—	--

SUMMARY.—The rainfall during the month of November has been generally good in the east and north of the Transvaal. Over the south-east and south the rainfall has been about the average, whilst at many places over the centre, west, and south-west the rainfall has been rather deficient.

Observations of Temperatures (from Self-registering Thermometers in Stevenson Screens).—December, 1908.

Place.	For the Month. Mean Max.	Mean Min.	Mean.	Highest.	Lowest.
	degs.	degs.	degs.	degs.	degs.
Bloemhof	87·4	61·6	74·5	96·0 on 9th & 10th	52·0 on 24th
Johannesburg—					
Joubert Park ...	77·9	56·7	67·3	86·2 „ 10th	48·5 „ 24th
Observatory ...	76·0	55·7	65·8	84·2 „ 26th	48·8 „ 19th
Pretoria, Arcadia ...	86·7	59·8	73·2	95·6 „ 10th	52·0 „ 21st
Volksrust	76·6	53·8	65·2	84·2 „ 11th	49·0 „ 19th, 20th

Temperatures were about two degrees above the average.

Rainfall Return for December, 1908.

(Including Rainfall since 1st July last and the corresponding averages for previous season.)

Note.—The rainy season is measured from 1st July in one year to the 30th June in the next.

District.	Place.	Month. Dec., 1908. Ins.	Days.	Season. From 1st July, 1908. Ins.	Days.	Averages. Month. Ins.	Days.	Averages. Season. Ins.	Days.
Barberton ...	Barberton	3·50	12	13·13	59	3·67	12	11·86	40
	Komatipoort	1·64	5	8·60	24	4·77	--	10·46	28
Bethal ...	Bethal	3·88	11	14·38	45	3·92	12	12·75	40
Bloemhof ...	Bloemhof	2·49	12	8·51	37	2·44	9	7·41	29
Carolina ...	Carolina	2·34	7	11·92	35	3·91	—	13·43	—
Ermelo ...	Ermelo	3·56	15	15·15	48	4·30	15	14·65	46
Heidelberg ...	Vereeniging	4·74	13	12·73	49	3·44	12	10·84	37
Lydenburg ...	Pilgrims Rest	6·81	18	18·24	61	4·89	17	13·31	54
Marico ...	Zeerust	1·31	13	8·28	41	2·93	11	9·48	31
Middelburg ...	Middelburg	2·95	12	12·66	41	3·91	12	13·32	39
Potchefstroom	Klerksdorp	1·69	9	10·66	34	2·78	10	8·46	33
Pretoria ...	Govt. Buildings, Pretoria	1·74	13	8·54	35	—	—	—	—
	Arcadia, Pretoria ...	2·37	16	10·18	43	—	—	—	—
	Modderfontein	2·91	10	12·05	40	4·04	12	11·11	36
Rustenburg ...	Rustenburg	3·45	13	11·61	37	—	—	—	—
Swaziland ...	Mbabane	6·18	17	22·70	85	7·26	17	20·28	63
Wakkerstroom	Volksrust	5·14	14	20·35	52	5·00	13	—	—
	Wakkerstroom	4·19	11	16·39	37	—	—	—	—
Waterberg ...	Potgietersrust	3·09	9	10·86	33	4·92	11	11·01	29
Witwatersrand	Krugersdorp	1·00	11	9·59	40	3·24	13	10·10	37
	Govt. Observatory, J'burg	2·06	13	11·39	45	3·63	14	12·20	40
	Joubert Park, J'burg ...	4·23	13	14·32	49	4·48	13	13·78	41
Wolmaransstad	Wolmaransstad	4·13	12	—	—	3·00	10	—	—
Zoutpansberg	Pietersburg	4·52	7	10·14	29	4·22	9	9·02	25

Taking the whole of the month and the Colony the amount of rainfall has been normal; a few places were under the average, whilst others were above. The season's (six month's) rainfall is also normal. Most of the rain fell in the first half of December, so that the month ended warm and dry.

Observations of Temperatures (from Self-registering Thermometers in Screens).—January, 1909.

Place.	For the Month. Mean Max.	Mean Min.	Mean.	Highest.	Lowest.
	degs.	degs.	degs.	degs.	degs.
Bloemhof	82·2	63·1	72·6	93·0 on 1st	65·0 on 19th
Johannesburg—					
Joubert Park ...	72·1	57·3	64·7	86·7 „ 4th	49·0 „ 19th
Observatory ...	71·5	56·5	64·0	82·9 „ 4th	47·9 „ 19th
Komatipoort	90·0	70·3	80·2	105·0 „ 5th	66·0 „ 2nd, 4th, 16th, 18th, 19th, 23rd
Pietersburg	79·9	60·7	70·3	89·5 „ 4th	54·0 „ 2nd
Pretoria, Arcadia ...	80·3	60·9	70·6	94·0 „ 4th	53·4 „ 19th
Volksrust	72·3	55·1	63·7	82·7 „ 4th	46·5 „ 19th
Zeerust	82·4	63·3	72·8	98·0 „ 4th	56·4 „ 19th

Temperatures by day were about four degrees below the average, and by night about three degrees above the average. The mean temperature of the month was about normal. The warm heavy rains of the month equalized temperatures.

Rainfall Return for January, 1909.

(Including Rainfall since 1st July last and the corresponding averages for previous season.)

District.	Place.	Month: Jan. 1909. Ins.	Days.	Season: From 1st July, 1908. Ins.	Days.	Averages: Month. Ins.	Days.	Season. Ins.	Days.
Barberton ...	Barberton	16·52	21	29·65	80	6·28	13	16·15	54
	Komatipoort	10·04	15	19·01	41	1·00	9	14·80	39
Bethal ...	Bethal	7·00	19	21·38	64	5·61	16	18·53	56
Bloemhof ...	Bloemhof	9·01	16	17·52	53	4·84	12	12·28	41
Carolina ...	Carolina	8·47	19	21·57	58	6·52	--	19·79	—
Ermelo ...	Ermelo	7·66	16	22·65	64	4·55	16	22·57	63
Heidelberg ...	Vereeniging	12·69	24	25·42	73	5·07	13	15·90	52
	Heidelberg	13·01	19	25·97	67	5·64	13	18·33	52
Lydenburg ...	Pilgrims Rest	22·79	23	40·73	84	9·22	19	22·49	73
Marico ...	Zeerust	16·65	22	25·09	64	6·08	14	15·60	46
Middelburg ...	Middelburg	9·76	19	22·42	60	5·54	17	18·94	57
Piet Retief ...	Piet Retief	14·95	22	33·13	82	7·65	14	24·01	—
Potchefstroom	Potchefstroom	7·63	19	18·93	56	5·18	13	15·24	46
	Klerksdorp	8·53	21	19·51	63	4·71	17	13·24	52
Pretoria ...	Govt. Buildings, Pretoria	21·21	19	29·75	54	6·54	14	16·64	47
	Arcadia, Pretoria ...	22·12	22	32·30	65	7·71	16	19·43	54
	Modderfontein	19·61	22	31·66	62	6·46	16	17·74	52
Rustenburg ...	Rustenburg	15·09	22	26·70	59	—	—	—	—
Standerton ...	Standerton	6·48	17	20·94	65	—	—	—	—
Swaziland ...	Mbabane...	25·39	22	48·09	107	10·44	17	30·76	81
Wakkerstroom	Volksrust	9·06	21	29·41	73	6·49	16	21·85	61
	Wakkerstroom	8·25	18	24·64	45	4·87	13	20·91	49
Waterberg ...	Potgietersrust	7·41	14	18·27	47	5·96	12	18·87	45
Witwatersrand	Krugersdorp	21·56	20	31·15	60	6·74	17	17·14	55
	Joubert Park, J'burg ...	19·98	25	34·30	74	6·95	17	20·73	58
	Govt. Observatory, J'burg	18·42	23	29·81	68	6·96	17	19·16	57
Wolmaransstad	Wolmaransstad	9·25	21	—	—	4·93	14	—	—
Zoutpansberg	Pietersburg	4·48	14	14·62	43	3·39	11	12·52	36
	Leydsdorp	16·99	14	27·58	44	—	—	—	—

Summary.—The January rainfall both in quantity and number of rainy days forms a record over the greater part of the Transvaal. The rainfall was particularly heavy and continuous over the centre and the eastern and western borders. Over the Districts of Ermelo, Bethal, Middelburg, Standerton, and Carolina, and parts of the Zoutpansberg and Waterberg, the rainfall was good, but it was not extraordinary. Floods with great damage and loss of life are reported from central districts.

The rainfall for the season (1st July, 1908—31st January, 1909, seven months) is above the average, except in the Waterberg, where it is slightly deficient.

Observations of Temperatures (from Self-registering Thermometers in Thermometer Screens).—February, 1909.

Place.	For the Month. Mean Max.	Mean Min.	Mean	Highest.	Lowest.
	degs.	degs.	degs.	degs	degs.
Bloemhof	77·2	60·1	68·6	90·0 on 5th	56·0 on 17th, 21st, 22nd
Johannesburg—					
Joubert Park ...	69·7	55·6	62·6	76·2 „ 28th	49·5 „ 4th
Observatory ...	69·7	55·4	62·6	75·4 „ 16th	49·0 „ 21st
Komatipoort	83·2	66·0	74·6	95·0 „ 11th	62·0 „ 17th
Pietersburg	77·7	59·8	68·8	85·0 .. 3rd	54·0 „ 23rd, 24th
Pretoria, Arcadia ...	78·2	59·5	68·8	85·9 .. 2nd	53·0 „ 21st
Volksrust	71·9	54·4	63·2	80·4 .. 3rd	44·5 „ 18th
Zeerust	78·5	61·7	70·1	87·2 „ 28th	58·4 „ 21st

Mean temperatures have been some three degrees below the average for February. Maximum temperatures were five degrees below average and ten degrees below those of February, 1908. Temperatures by night were about two degrees below average. Generally, a cool and mild month with no temperature extremes.

Rainfall Return for February, 1909.

Note.—The rainy season is measured from 1st July in one year to the 30th June in the next.

District.	Place.	Month. Feb., 1909. Ins.	Days.	Season. From 1st July, 1908. Ins.	Days.	Averages. Month. Ins.	Days.	Season. Ins.	Days.
Barberton ...	Barberton	8·99	21	38·64	101	5·48	12	23·61	66
	Komatipoort	7·90	15	26·91	56	5·42	9	20·22	48
Bethal ...	Bethal	10·52	21	31·90	85	5·44	12	23·88	69
Bloemhof ...	Bloemhof	9·17	16	26·69	69	3·61	12	17·08	56
Heidelberg ...	Heidelberg	8·64	19	34·61	86	6·12	12	24·47	64
Marico ...	Zeerust	8·69	15	33·78	78	4·91	12	20·52	59
Middelburg ...	Middelburg	8·06	19	30·48	79	4·88	12	23·82	69
Piet Retief ...	Piet Retief	8·23	18	41·36	100			-	
Potchefstroom	Potchefstroom	5·18	14	24·11	70	4·32	11	19·58	58
Pretoria ...	Arcadia, Pretoria ...	6·38	18	38·68	83	4·58	13	24·01	68
	Govt. Buildings, Pretoria	5·10	16	34·85	70	4·37	12	21·20	59
	Modderfontein	7·70	19	39·36	81	5·24	14	22·98	66
Wakkerstroom	Volksrust	8·72	20	38·13	93	5·77	14	27·62	75
Waterberg	Nylstroom	6·10	11	25·23	64	4·66	11	20·27	56
	Potgietersrust ...	4·25	7	22·48	54	4·20	9	22·29	53
Witwatersrand	Krugersdorp	5·15	18	36·30	78	4·96	14	21·82	69
	Govt. Observatory, J'burg	6·57	18	36·38	86	5·29	14	24·46	72
	Joubert Park, J'burg ...	8·68	23	42·98	97	5·76	16	28·19	76
Wolmaransstad	Wolmaransstad	11·24	18	-		—	—	—	—
Zoutpansberg	Pietersburg	4·13	10	18·75	53	4·03	9	16·55	46

February was again a record month for heavy rains, cloudy skies, and damp, cloudy weather. The rainfall over the north-west of the Waterberg and west of the Zoutpansberg was only about normal. Many old springs which had dried up have restarted, old pans filled, etc., and generally the country seems to be returning to its condition of 25 to 30 years ago. In the meantime excessive moisture is causing loss to the farming industry.

Pretoria and Johannesburg Market Prices.

(Produce Prices supplied by the Commercial Agency Co., Limited, Seed and Produce Merchants, No. 116 Vermeulen Street, Telephone No. 165, Box 784, Pretoria; and by Messrs. Hubert Morisse & Co., Produce Merchants and Commission Agents, Loveday and Frederick Streets, Box 63, Johannesburg. Live Stock Prices by Mr. Alfred Webb, Produce Agent to the Cape Government, 1 Parker's Building Market Street, P.O. Box 2342, Johannesburg.)

PRETORIA.

Description.	*December*, 1908.		*January*, 1909.		*February*, 1909.	
	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Bran, per bag	0 6 6	0 7 6	0 6 9	0 9 0	0 7 6	0 8 3
Barley, per bag	0 11 6	—	0 14 0	—	—	—
Butter, Fresh, per lb. ...	0 0 10	0 1 3	0 1 0	0 1 3	0 1 0	0 1 3
Beans (kafir), dry, per bag	—	—	0 19 0	—	—	—
Ducks, each	0 2 4	0 3 0	0 2 2	0 2 9	0 2 2	0 3 2
Eggs, per doz.	0 0 8	0 1 0	0 1 5	0 1 11	0 1 10	—
,, (fresh) ...	0 1 6	0 3 0	0 1 6	0 3 2	0 1 11	0 3 3
Forage, 100 bundles ...	0 7 6	0 19 6	0 7 6	1 2 9	0 11 6	1 4 9
Fowls, each	0 1 3	0 2 8	0 1 0	0 2 7	0 1 7	0 3 4
Hay, per bale	0 0 5	0 1 0	0 0 4	0 0 11	0 0 9	0 1 3
Kaffir Corn, per bag ...	0 14 9	0 18 6	0 13 6	0 17 0	0 16 0	—
Green Lucerne, per doz. bundles	0 0 9	0 1 6	0 0 8	0 1 4	0 0 8	0 1 0
White Mealies, per bag ...	0 14 0	0 16 9	0 13 9	0 16 0	0 13 0	0 15 0
Yellow Mealies ,, ...	0 16 6	0 17 6	0 15 9	0 17 0	0 15 0	
Onions, per bag	0 5 0	0 10 0	0 4 6	0 10 0	0 4 6	0 7 6
Pigs, each	1 7 0	2 8 0	0 18 0	2 6 0	—	—
Pigeons, each	0 0 9	—	0 0 9	—	0 0 8	—
Pumpkins, each	—	—	0 0 3	0 0 7	0 0 5	0 1 3
Potatoes, per bag	0 11 6	0 18 6	0 8 6	1 1 0	0 7 0	0 18 0
Oats (seed), per bag ...	0 11 3	0 12 6	0 10 9	—	0 9 9	—
Boer Meal, per bag ...	1 5 6	1 6 6	—	—	—	—
Cock Turkeys, each ...	0 10 0	0 17 6	0 4 0	0 16 0	0 4 3	0 11 6
Muscovies, each	0 2 3	0 3 0	0 1 9	0 3 0	—	—
Tobacco, per roll	0 0 3	0 1 1	—	—	—	—
Wheat, per bag	0 19 9	1 2 0	0 19 3	1 3 0	0 19 9	1 0 6
Firewood, per load ...	0 9 0	2 9 0	0 9 0	1·17 6	0 11 0	2 0 0
Chaff (pressed) per bale ...	0 0 8	0 1 3	0 0 8	0 1 7	0 0 11	0 1 7
Rye, per bag	—	—	0 15 3	—	—	—
Chaff, per bale	—	—	0 4 3	—	—	—

JOHANNESBURG.

Description.	*December*, 1908.						*January*, 1909.						*February*, 1909.					
	Lowest.			Highest.			Lowest.			Highest.			Lowest.			Highest.		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
Barley, per 163 lbs. ...	0	8	6	0	11	0	0	9	6	0	13	6	0	10	0	0	16	6
Bran, per 100 lbs. (Colonial)	0	7	0	0	7	3	0	7	0	0	7	3	0	7	3	0	7	9
Chaff, best, per 100 lbs. ...	0	2	0	0	3	6	0	2	9	0	3	6	0	2	0	0	3	6
Eggs, per doz. (Colonial) ...	0	0	8	0	1	4	0	1	2	0	1	9	0	1	7	0	1	10
Salt, per bag	0	4	9	0	5	6	0	4	9	0	5	6	0	4	9	0	5	6
Forage (Transvaal) ...	0	4	6	0	6	0	0	5	6	0	6	6	0	5	3	0	6	6
„ (Colonial), best, 100 lbs	0	5	0	0	6	3	0	6	0	0	6	6	0	6	3	0	6	6
„ „ med. „	0	3	9	0	4	9	0	4	3	0	5	6	0	4	0	0	5	6
S. Meal, best fine	1	4	6	1	7	6	1	1	6	1	5	9	1	4	3	1	7	6
Rye	0	13	6	0	14	6	0	13	3	0	13	9	0	12	6	0	13	2
Wheat	0	18	6	1	1	6	0	15	0	1	0	6	0	19	0	1	1	6
Mealies, Hickory King Whites	0	13	9	0	15	6	0	12	9	0	14	8	0	13	3	0	14	5
„ (O.R.C.), Whites ...	0	13	9	0	15	4	0	12	6	0	14	3	0	13	0	0	13	10
„ Yellow	0	14	6	0	15	6	0	12	0	0	15	3	0	12	4	0	13	6
Kaffir Corn, per 203 lbs. ...	0	14	0	0	16	9	0	12	6	0	15	4	0	10	10	0	13	6
Hay, sweet (Transvaal) ...	0	3	0	0	3	6	0	3	0	0	3	6	0	3	0	0	3	6
Lucerne, per 100 lbs. ...	0	4	0	0	5	9	0	4	0	0	5	9	0	4	0	0	5	6
Manna	0	4	0	0	4	9	0	4	6	0	5	0	0	2	6	0	5	6
Transvaal Hay	0	0	6	0	1	5	0	0	7	0	1	0	0	0	8	0	1	11
Oats, per 153 lbs... ...	0	8	6	0	13	6	0	9	6	0	12	3	0	6	6	0	11	6
Potatoes, best, per 153 lbs.	0	12	0	1	2	6	0	10	6	1	6	0	0	12	6	0	19	6
„ med. and inferior...	0	6	0	0	18	0	0	6	0	0	17	6	0	6	0	0	13	0
Onions, per 120 lbs. ...	0	6	0	0	14	6	0	6	0	0	9	0	0	6	0	0	9	0
Turkeys, cocks	0	7	6	0	16	0	0	7	6	0	13	0	0	6	6	0	17	0
„ hens	0	4	9	0	6	6	0	3	6	0	6	6	0	3	6	0	5	6
Fowls	0	1	4	0	2	9	0	0	9	0	2	6	0	1	0	0	2	6
Ducks	0	1	9	0	3	0	0	1	9	0	2	6	0	1	6	0	2	5
Geese	0	4	9	0	5	6	0	4	9	0	5	6	0	3	9	0	5	9
Pigeons	0	0	7	0	0	10	0	0	7	0	0	8	0	0	7	0	0	8
Butter (O.R.C.), per lb. ...	0	0	8	0	1	1	0	0	7	0	1	1	0	0	5	0	1	0
Pumpkins, each	0	0	3	0	0	6	0	0	3	0	0	9	0	0	3	0	0	9
Beans, per 200 lbs. (sound)	0	16	6	2	8	0	0	16	6	2	6	0	0	16	6	2	2	6
Boer Goats	0	13	0	1	2	6	1	0	0	1	2	6	0	10	0	1	0	0
Donkeys	6	0	0	7	0	0	5	0	0	7	0	0	5	0	0	7	0	0
Oxen (slaughter)	8	0	0	17	0	0	8	0	0	16	0	0	8	0	0	15	0	0
„ (dressed), 100 lbs. ...	1	10	0	1	18	0	1	10	0	1	18	6	1	10	0	1	17	6
Pigs, live, per lb.	0	0	3	0	0	4	0	0	3	0	0	4	0	0	3	0	0	4
Sheep (hamels)	0	14	0	1	6	6	0	14	0	1	7	0	0	14	0	1	4	6
„ (dressed), per lb. ...	0	0	4½	0	0	5½	0	0	4½	0	0	5½	0	0	4¼	0	0	4¾

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Germs and Milk.

BY ROBERT PAPE, Superintendent of Dairying.

GERMS are small microscopical plants, invisible to the naked eye. They consist of a membrane (skin) of a material similar to cellulose, enveloping cellular proteid or protoplasm. The shape varies. Some are round and these are called micrococcus, diplococcus, streptococcus, staphylococcus, etc., according to the agglomerates they form. Others are rod-shaped (bacterium), and if a little longer they are called bacillus. Very long threads are called leptothrix. I shall not mention all the different names of the different shapes, those mentioned are sufficient for the main divisions.

Some germs are motionless, whereas others show voluntary movement by means of little hairs or ciliae.

For measuring the dimensions of germs, a special unit "mikron" is used, that is 1-1,000 of a millimeter or about 1-25,500 of an inch. Like all life forms, germs reproduce, which usually happens by means of division. That is, the germ splits into two, and each division lives on as a separate germ. About the rapidity of the increase Cohn says the following :—" Assuming that a germ divides within an hour into two, these again within an hour into four, etc., then in twenty-four hours the increase would be over sixteen and a half millions, after two days it would be forty-seven trillions and after a week the number would be represented with fifty-one figures." According to Cohn a bacillus weighs perhaps 0.000,001,571 milligram. After twenty-four hours the progeny of one bacillus would weigh 1.40 milligram, after two days 1 lb. 1½ oz., after three days over 730 tons. In these calculations it is supposed of course that development can go on unchecked. In practice this is not the case and the development is limited by the supply of nourishment and sometimes by the toxines or poisons produced by the germs themselves.

A second important means of reproduction is the formation of spores. Not all germs form spores. A large section of germs requires oxygen to live, and these species are called "aerobic." For others again oxygen is a poison. These are the "anaerobic" species.

In order to live, all germs want nourishment, which chiefly consists in carbon and nitrogen. As the germs contain no chlorophyl they must feed on carbon compounds and cannot isolate it from carbon dioxide.

Milk and milk products form a splendid medium for the development of germs. Most of the changes that occur in milk are chiefly, if not entirely, due to the action of germs. Some of the germs disintegrate the proteids in milk, whereas others live on the milk sugar. The various changes in the milk caused by germ action are so numerous and intricate that all I can do here is to give the barest outline of them.

A particular class of germs that calls for attention more than others, as without their intervention the process of butter and cheese making would be highly difficult if not impossible, is formed by the lactic acid bacteriae. A great number of species of these are known and have been described, but we are not certain that all have been discovered nor that all the species catalogued are really all different.

These germs disintegrate sugar, changing it into lactic acid, water, and in some cases gases. The lactic acid formed, acts on the casein, and is by itself sufficient to "mature" the cheese. The "souring" of milk is due to the action of these germs. The lactic acid produced precipitates the casein, hence the peculiar consistency of sour milk. If milk were absolutely free from all acid, it would not curdle, and no cheese could be made, therefore the lactic acid bacteriae are indispensable. On the other hand a superabundance will acidify the milk too much, and the quality of the butter or cheese made out of such milk will suffer.

Thus we cannot make butter or cheese without lactic acid bacteriae, but must *regulate* their growth so as to prevent a superabundance. This regulation of the growth of these bacteriae is what the experienced cheese or butter maker does in various manipulations. The action of these germs may be considered as a kind of fermentation, which requires careful observation and control.

Milk contains various other germs, which as a rule are soon repressed by the rapid vegetation of the lactic acid bacteriae. Yet if through some cause or other the vegetation of the lactic acid bacteriae is checked, the other varieties may develop rapidly and cause undesirable effects. A species frequently met with in milk is bacterium coli commune, an intestinal germ present in all faeces. Though this germ is always present in the human and animal intestine, and is even useful there as it protects the intestinal wall, it becomes dangerous if it reaches the stomach.

If perchance minute particles of cow dung should get into the milk it will be infected with bacterium coli commune, and such milk constitutes a danger to the consumer, especially to infants, who may fall ill seriously and even die of the effects.

Bacterium coli commune should be considered pathogenic (illness producing), and consumption, in the raw state, of milk containing this germ should be prevented. Extreme cleanliness in treating the milch cow and in milking, and a pure water supply protected from being defiled by animal faeces is the best way to prevent this germ from entering the milk. From what I have seen of milking in South Africa I venture to say that I do not expect that any milk drawn in a kraal is free from this noxious germ.

Real pathogenic germs are occasionally found in milk, which accordingly may be the medium of transmission for infectious disease. Typhoid and tuberculosis for instance may be spread through impure milk.

The duty the milk purveyor owes to the general public is to supply a milk free from dirt or any pathogenic germs, and in order to accomplish this his cattle ought to be under the continuous supervision of a veterinary

surgeon. Further, all care should be taken to draw the milk free from any impurities.

Germs may be killed by the action of certain poisons; unfortunately the doses required to kill off all germs are a decided menace to the health and well-being of the human consumer; hence we cannot hope to free the milk from germs by toxic action. Most germs may be killed by heat, and at present this is the most effective method applied for rendering infected milk harmless.

Two systems of milk treatment are based on the killing of the germs by heat, one is pasteurisation the other is sterilisation. In sterilisation the temperature of the milk is (under pressure) carried *over* the boiling point, and this will kill most species but not all. The *spores*, which may be compared to seed from which bacteriae germinate, show a great resistance to heat and as a consequence sterilised milk may subsequently show bacterial development caused by the surviving spores.

If real sterile milk is required the system of "fractional sterilisation" is applied. The milk is sterilised at certain intervals. In the intervals the spores obtain the opportunity to develop, and then they are killed by subsequent sterilisation. Milk that has been sterilised only once and kept a long time in a closed bottle or tin may possess toxic properties due to the action of a species of peptonising germ described by Flügge.

Most (if not all) of the real pathogenic germs may be killed by carrying the milk to a temperature well under the boiling point, followed by a sudden chilling to a temperature as near the freezing point as possible. This is the process of pasteurisation. The milk is heated up to 167 to 194 degrees F., and suddenly chilled to well under 50 degrees, say 40 degrees if possible.

The sudden fall in temperature of over 100 degrees has very much the same effect as raising it to 220 or 230 degrees. Pasteurisation is largely adopted in buttermaking for producing a cleaner flavoured, better keeping butter. The heating and subsequent chilling produce a medium which is practically sterile. By inoculating the cream with those species of germs that are known to exert a beneficial influence, the quality of the butter may be improved. The inoculation is done by pure cultures or "starter" prepared in special laboratories and sold by several firms.

It is very difficult to obtain from the ordinary trade a pure culture that is absolutely free from all taint, but in general the commercial cultures give very satisfactory results.

As the milk is nearly sterile at the moment the pure culture is introduced the desirable germs come consequently under conditions favourable to rapid growth.

The problem of pasteurising milk for cheesemaking has not yet been entirely solved. I have made several experiments in turning pasteurised milk into cheese, but found that the ordinary process has to be modified to such an extent that it really came to learning cheesemaking all over again on different lines.

The curdling properties of the milk are destroyed by pasteurisation, and must be revived artificially. The development of the lactic acid bacteriae is different from the growth in raw milk. Still, before very long, the correct way of turning pasteurised milk into cheese will be discovered. I may add that I have made a quantity of first-class cheese from pasteurised milk, which shows that it is possible to do so. Yet when I asked the cheesemaker who acted as my help to make the cheese without my aid I noticed that he could not grasp the intricacies of the new process.

In several countries the use of pure cultures or starters has been introduced into cheesemaking, though previous pasteurisation of the milk is omitted. In such cases the milk is *not* sterile when the pure culture is introduced, but by means of the culture the number of lactic acid bacteriae is increased, and they are supported in their competition with other species.

Milk may be compared to a battlefield. Different species of germs are present and try to develop to the exclusion of all others. The food supply is limited, and some species are better qualified for the disintegration of the available food. The survival of the fittest is the natural consequence of this state of affairs, and care must be taken to make the desired germs the fittest.

In this struggle for life, taking place in the milk, not all species are directly at war with each other. Freudenreich has shown that the ripening of Gruyère cheese is chiefly due to the joint action of four species of lactic acid bacteriae. Such phenomena are called "Symbiose"; the germs are, so to say, working hand in hand. Other germs work in "Metabiose" in succession. The best known example is the metabiose of germs disintegrating the proteids.

The proteid molecule is the most complicated known, in fact not much is known of the real composition as yet. The proteids are built up from the elements carbon, hydrogen, nitrogen, sulphur, and oxygen; in short the same elements as all inorganic matter. But in addition the proteids always contain inorganic elements, notably calcium.

Now it is a general law that the more complicated a structure is, the easier the demolition or decomposition becomes, and the disintegration of proteids is a comparatively easy matter. A fairly low temperature is sufficient to break up some of the proteids. Certain germs possess the faculty of disintegrating the proteids, but each species has a limited sphere of action. Each species will attack the proteid molecule at a certain stage of structure and disintegrate it, simplifying the structure until it has been reduced to a lower degree. Then the action of the first agent stops. But now another germ sets to work. First it was powerless, as it could not act on the more highly organised proteid, it can act on the simplified structure, reducing it one degree, and must suspend work. A third species continues the work of destruction, and a fourth, etc., till at last the highly complicated compound has been reduced to very simple bodies like water, carbon dioxide, and ammonia. This process which I have here sketched in a few lines, is the *decay* of proteids. A long chain of processes gradually breaks up the proteids.

But there is another chain of processes disintegrating the proteid molecule, which we call the curing or ripening, the maturing, of cheese. Sometimes it is difficult to say with certainty whether a special proteid compound belongs to the "curing chain" or to the "decaying chain." All that I can say is that the processes, though not identical, are very similar. No scientist is able yet to tell the practical cheesemaker with any degree of certainty which particular manipulation pushes the casein of the milk towards decay and which towards curing. Yet an expert cheesemaker when examining his ripening cheeses is able to tell at a glance which are curing and which are simply decaying. All science can do for him is to give him an insight into the connections of the various processes due to germ life.

Another typical instance of metabiose is the disintegration of the milk sugar. Milk sugar belongs to the "double sugars," and by the action of *Saccharomyces lactis* it is "inverted"; that is, split up into "single" sugars

of less elaborate structure. Several ordinary ferments (like yeast) that could not act on the double sugars, ferment the single sugars.

Up till now I have only spoken of germ action in disintegrating various compounds, but in order to understand more clearly what happens you must look more closely into the process.

Germs do more than simple ingestion and multiplication. They exude various compounds, ferments which have distinct chemical properties. All germs form lactic acid, and in fact lactic acid may be called the natural consequence of the phenomenon known as "life." But only those germs that form considerable quantities of lactic acid from milk sugar are called the lactic acid bacteriae proper. The action of these species is not limited to acid production. Several ferments are formed. One of them is a chymosine, showing the same properties as the chymosine which forms the active principle of the rennet used in cheesemaking. This species causes the spontaneous coagulation (curdling) of milk. It will curdle milk very much in the same style as rennet will. A sharp distinction should be made, therefore, between the growth of the germs, the action of the exudates, ferments, and toxines. The same effect as is obtained by the action of *Saccharomyces lactis* (inverting milk sugar) will follow, if to a solution of milk sugar, lactic acid of a certain strength is added, though milk sugar and lactic acid have been sterilised previously.

If in a pure culture of pathogenic (illness producing) germs the bacteriae have died off or been killed, the toxines (poisons) remain; on injection into the body of a living animal these toxines produce the same lesions as if a pure culture of the virulent bacteriae had been injected.

But in case of injection of a dead culture, the quantity of toxines is *limited*, and though the lesions are produced, the illness is not. In case of injection of a live culture the germs multiply in the body of the host, the toxines increase in quantity, the *illness* is produced. From this it will be seen that many infectious diseases may be compared to a poisoning process. Bearing this in mind it will become clear that pasteurised milk or cream is not at all the same thing as raw milk that never contained any noxious germs. The germs have been killed by the pasteurisation, but the toxines remain. In cases where the same milk is supplied regularly to the same consumer, even though the milk is pasteurised the toxines ingested daily may prove a menace to health, the daily ingestion of the toxines acting similarly to a mild attack of the disease.

Therefore, pasteurising milk and cream for human consumption can never be anything but a palliative—a "next best." The milk supplier should strive after *aseptic* milk, that is, milk as free from germs as it can be obtained.

Pasteurisation of milk and cream has the effect of impairing the digestibility by coagulating a portion of the proteid and the destruction of ferments which aid the digestion. Therefore it is a mistake to feed invalids and infants on pasteurised or sterilised milk if there is any possibility of obtaining raw milk free from dirt and noxious germs.

I have said already that in butter and cheese making the growth of the lactic acid bacteriae or (which comes practically to the same thing) the development of lactic acid, must be *regulated*. Going on to cheese-making more especially, a certain quantity of lactic acid must be developed at the time the cheese goes to press. But it is not indifferent how this quantity is developed, whether rapidly or slowly. Each phase of the process has a certain required quantity of acid, and either more or less will depreciate the quality of the cheese.

In general it may be said that the quantity of lactic acid produced is proportionate to the number of living germs of a certain species, so you can regulate the quantity of lactic acid by regulating the development of the germs. Not all species of germs multiply in the same ratio, some are quicker, others slower, and according to the species you must retard or accelerate the growth in order to obtain the desired quantity of acid.

Experiments have been made with the use of pure cultures for cheese-making which proved clearly that some rapidly developing species of lactic acid germs spoilt the quality of the cheese, giving it a "curdy" or "chalky" texture, caused by the too rapid formation of acid.

Yet these same species can produce a splendid curd, provided that the growth of the germs be sufficiently retarded. Thus one and the same species may improve or depreciate the quality of the product, all depending on the proper regulation of the development. Now, the development can be accelerated or retarded by changing the conditions under which the germs have to grow; the first point to be ascertained therefore is what conditions each species requires to attain its best and most rapid growth.

Foremost amongst the dominating causes stands the temperature. The most favourable temperature for the development of the lactic acid bacteriae (the so-called optimum temperature) is somewhere near 30 degrees C. (86 degrees F.) The closer the temperature is to the optimum the more rapidly the germs will multiply. To accelerate development, the temperature should be brought nearer the optimum, to retard it should be brought further from this optimum. Not all the lactic acid species have the same optimum, thus say the temperature changes between 28 and 32 degrees C., it passes at the same time through the optimum of different species and consequently favours most the growth of different species. Suppose germ A has an optimum at 28 degrees, B at 29, C at 30, D at 31, and E at 32. At 28 degrees the species A will have the best chance of development and E the remotest; the chances in following order will be:—

1. A 2. B 3. C 4. D 5. E	At 30 deg. the chances will run	1. C. 2. B and D. 3. A and E.

At 32 degrees the chances will run exactly the reverse of the first list.

This explains how we can change the bacterial flora of the milk by changing the temperature. Another important factor is the degree of moisture, the moister the medium the easier the development. Consequently in cooking the curds (which makes them drier) you make them a less fit medium for germ development, quite apart from the temperature which may kill.

The conditions under which germs will develop differ with each species. Some bacteriae must have an acid medium to live whereas others again insist on an alkaline reaction. Moulds, for instance, must have an acid medium to flourish. In practical cheese and butter making it is not possible to make a mathematical calculation which specific effect each manipulation has on the growth of the germs. But the cheese and butter maker knows by the experience of himself and others that certain manipulations have approximately certain effects. If the desired effect is not quite reached the manipulation is to be modified.

In cheesemaking most of the renneting temperatures for various types of cheese are near 86 degrees F., or near the temperature optimum of the lactic acid bacteriae. As a consequence a vigorous development of acid may be expected during the whole process of cheesemaking as the temperature is kept very near this optimum. For some types of cheese (like Gruyère) it is desirable to give the germ development a severe check at a certain stage of the process. This is accomplished by scalding or cooking at a high temperature 50-55 degrees C. (122-131 F.) In other types (like sweet milk cheese) the check is not so severe and cooking is not carried over 90-95 degrees F. When the temperature of the curds drops under the optimum again, the growth is retarded.

In the Cheddar process the growth of germs is first *pushed* by the use of starter and the renneting temperature, next the growth is *retarded* by cooking till well over the optimum of the bacteriae. At the same time the curd becomes drier by heat action and thus a less adaptable medium. Lastly, the growth is accelerated again by cooling the curds.

The dry salting of the curds, or the brining of the cheese after pressing, exerts a severe check on the bacterial growth. To explain this fact I must refer to the osmotic phenomena. If a vessel be divided into two by a membrane and solutions of different salts are brought on either side of this membrane, the salts will pass through the membrane till on either side the salt solutions are exactly similar. Not all salts, however, will pass through a membrane, and not all membranes are equally permeable to salts.

Something similar happens when germs float in a solution. The germ itself is enveloped by a membrane, the liquid inside is under a certain pressure ("turgor") which keeps the membrane taut. The membranes of different germs differ in their conduct towards salts. Some membranes are permeable to certain salts, others are not.

Suppose germs are brought into a strong solution and the cell membrane is permeable to the salt, what happens? The salt penetrates through the membrane till, inside the germ and outside, the concentration of that salt solution is equal in strength. The germ does not vary in shape, and unless the salt is a specific germicide, the growth is not hampered.

If the membrane is impermeable to the salt the course of events is quite different. No salt can enter the germ, but the water contained in the germ can pass out through the membrane, attracted by the strong salt solution. The osmotic pressure, the turgor, is diminished, the germ shrinks together and the development is severely checked. This is called "plasmolyse." Hence the kitchen salt used in drysalting or brining the cheese acts as a check to those germs whose membranes are impermeable to kitchen salt.

After some time the germ may resume its ordinary shape, for few membranes are really impermeable to salts, the phenomenon is based on the fact that the salt can only penetrate very slowly. The germ on resuming its shape continues development, unless the salt employed were a germicide.

Bearing these facts in mind it becomes clear that drysalting the cheese before pressing, or brining after pressing, creates a vast difference. In the case of drysalting the check to the growth comes much earlier than in the case of brining. Then drysalting causes a somewhat uneven check.

It is practically impossible to make a thoroughly homogeneous mixture of salt and curds. The salt naturally dissolves at once in the moisture of the curd, but some particles of curd (and the germs enclosed) will be in touch with a strong brine solution, others with a weaker solution, hence the action of the check must be uneven.

After pressing, the cheese forms practically a solid block of curd, and when this is brought into a salt solution the brine will penetrate and spread more evenly and consequently cause a more even check. I will not say much here about the curing process of cheese as there is still too much disagreement among the several investigators. Suffice it to say that the curing is brought about, either directly or indirectly, by germ action. Some investigators hold that the proteids are broken down by the germs themselves, others hold that the ripening process is nothing but the chemical action of the various germ exudates.

The ripening of the soft varieties of cheese is best known and must be ascribed to the activity of certain moulds, as without them the cheese will not ripen properly.

For the curing of semi-hard and hard types of cheese, moulds are not required, in fact some cheese cures better if no vegetation of mould is tolerated on the crust. Roquefort and Gorgonzola cheese are carefully inoculated with mould (*Penicillium glaucum*) and the peculiar taste of these varieties is caused by the bodies produced by the *Penicillium*.

I left the buttermaking process after saying something about the pasteurisation of the cream. I must now say something about the maturing of the cream, to make this process clearer.

The maturing or ripening of cream is *not*, as is often erroneously assumed, a simple formation of lactic acid. Two processes should be distinguished. One is the formation of lactic acid, the other is the coagulation of proteids through the action of peptonising bacteriae. A good culture will start both processes in such a way that both the coagulation and the souring have reached the desired point at the same moment.

If this be not the case the cream may contain the requisite amount of lactic acid and yet be not sufficiently matured. Once the acid has reached a certain degree of concentration it will precipitate the proteid, and consequently prevent further coagulation.

If starters have been in use for some time, "transplanted" from day to day, it will be noticed that the lactic acid bacteriae gradually begin to dominate, it becomes more difficult to mature the cream properly, and the souring goes quicker and quicker. The peptonising germs are simply being crowded out. Therefore, the pure culture should be renewed frequently.

Nearly all the taints that occur in milk, butter, or cheese are due to the activity of germs, yet nearly every one of them can be prevented by a proper regulation of the process and not forgetting extreme cleanliness. Dirty milk-cattle and dirty milking habits may contaminate milk to such an extent that it becomes impossible to make a really first-class product.

Dirt and germs are inseparable companions, and dirt in milk means germs in that milk. Improperly cleansed milking pails are a frequent cause of contamination.

By "cleanliness" I want to express something beyond the ordinary acceptance of the word. A milking pail may be *clean* enough for anybody to drink out of it, and yet it may be still so dirty as to hopelessly contaminate any milk poured into it.

I have shown that pasteurisation of milk is only a "next best," and that the dairy farmer should try to draw his milk as free from germs as possible. But he will not succeed in obtaining absolutely sterile milk, and even if he did it would not help him, for the surrounding air is swarming with germs, floating about on account of their extreme lightness, gradually sinking down. A recent investigator coined the expression "germ-rain," and his results show that he was not exaggerating when he used this word. A pail with absolutely sterile milk standing uncovered would soon be infected by this germ-rain. To counteract this rain the milk cans and pails should have some covering, light enough to let the milk aerate and give off the gasses it contains. Further, the farmer can protect his milk and enhance the keeping qualities by *chilling* it. The farther the temperature is brought from the optimum of the germs, the less the germs will develop. At low temperatures the growth is very slow, but milk should not be actually frozen, for this causes physical changes depreciating the quality. The advantage of simply chilling milk over pasteurisation is that the digestibility is not impaired, and the ferments aiding digestion are not destroyed.

Milk drawn with proper hygienic precautions, well filtered and properly chilled, will keep long enough for ordinary trade purposes.

I have given here a brief outline of some of the changes caused by germs in milk. Those who want to know more of the subject can make a special study of it by perusing some of the many books published on this matter. But I should not advise it, for the ordinary dairy farmer does not require a minute knowledge of bacteriology. If germs play havoc with his produce he has always some means of coping with it, either by modifying his process or by improving his hygienic measures. Sometimes a taint in the milk may be caused by some disease of a milch cow. In most cases the farmer will be able to detect the offending cow.

Several simple tests can be applied by a dairy farmer which will give him all information required about the properties of the milk.

Varieties and Breeds of Maize for the Transvaal.

By Joseph Burtt-Davy, F.L.S., Government Agrostologist and Botanist.

The keen interest now being taken in maize growing has led to many enquiries of this Department as to which is the best kind to grow in the Transvaal.

As I have frequently explained to farmers attending our agricultural shows, there is not, and probably never will be, any one breed or variety of maize which can be said, without reserve, to be the best for general cultivation throughout the Transvaal. Maize is sensitive to changes in climate or soil, and a breed which proves suitable in one district is not equally suited to all, owing to the great variations in altitude, temperature, moisture, and soil between different parts of the country.

Speaking generally, dent maize (sometimes called "flat") is the best for the main crop, as it usually gives the best yields, and is in greatest demand. The flint or "round" breeds are most suitable for localities where the rainfall is limited and the growing season short, or for planting after the last date suitable for the dent breeds, to increase the acreage under crop. On the other hand, the flint breeds are generally richer in protein than most of the dents, and therefore are more nutritious for stock-feeding purposes; but on account of their lower yield they cannot be recommended for the main crop where dents can be grown satisfactorily. A certain amount of flint maize is useful on every farm, however, for stock feed; on account of its hardness it should be crushed before use. Yellow colour does not appear to indicate higher feeding value in the flint breeds, but there does not seem to be any oversea demand for white flints.

Hickory King is now more widely grown in South Africa than other breeds of dent maize. It is in demand on the mines, though it does not appear to command a higher price than any other well-grown breed of white dent, unless possibly when there is a temporary glut in the market. For the export trade, well-grown Hickory King has met with a favourable reception on the European market, especially among manufacturers of cornflour and among distillers and brewers. At present this special demand is somewhat limited, but the difference in price already obtained indicates that if the trade is carefully fostered by rigid grading and the exclusion of all but the very best from the "choice white flat" grade, there is a possibility of securing increased demand and still better prices for our best Hickory King.

For the grade known as fair average quality ("F.A.Q.") yellow dents or "flats" are in demand for stock-feeding purposes, but yellow flints ("rounds") may be of equal value if of good quality. Our export trade is too young to enable us to speak definitely on the desirability of keeping yellow dents and yellow flints separate; it will depend on the care exercised in grading at the ports of export whether we can develop a special demand for the flint classes commanding a sufficiently higher price to compensate for the extra trouble involved in grading and shipping in separate consignments.

As far as the supply of the present markets is concerned, the course for the Transvaal farmer to follow seems clear, viz.:—

(1) To produce a very "choice" grade of Hickory King in order to build up a promising, though at present somewhat limited, export trade in this class of maize.
(2) To produce a good quality of white dent maize of the "F.A.Q." grade for use on the mines.
(3) To grow a "choice" quality of yellow maize, either flint or dent, for the export trade, to be used for stock feed in Europe.
(4) To grow a limited amount of "F.A.Q." flint maize (preferably yellow) for feeding his own stock and for export when the price warrants.

In the present condition of the market farmers will probably find it better to limit their export trade to the classes indicated above, though it is possible that "F.A.Q." white may eventually be in demand for the export trade.

With the exception of choice Hickory King for export, and flint maize for local stock feed, it does not appear to matter what particular breed of maize is grown so long as it meets the above general requirements. From the farmer's point of view, therefore, the question resolves itself into which breed will give him the best yield of maize of good quality under the conditions of climate and soil of his particular farm.

On the extreme high veld farmers generally recognise that Hickory King is too risky a crop owing to the danger of early frost: many thousands of bags are annually lost from this cause. Where this is the case farmers would be well advised to discontinue growing Hickory King, except for very early planting, and to grow a sort which will supply one of the three other classes of merchantable grain mentioned above White dents, such as Champion White Pearl, Iowa Silver Mine, Wood's Northern, or Wisconsin, would probably be quite as suitable as Hickory King for use on the mines. For the export trade for stock feed, early maturing yellow dents, such as Chester County Mammoth, King of the Earliest, Eureka, or Star Leaming, can generally be grown where the season is too short for Hickory King.

In the Western Transvaal the season is sometimes as short as on the extreme high veld, not from early autumn frosts, but owing to lateness of arrival of the spring rains. Where this is the case early maturing sorts, such as those already mentioned, may be as desirable as on the high veld, but the question of greater heat and lower rainfall must be taken into consideration. On this account it would be well for farmers to make a comparative test side by side, and in the same season, of each of five or six of these breeds, in order to determine which will give the most satisfactory results under those conditions. Late maturing breeds, such as Austin's Colossal, and breeds which suffer from drought, such as Boone County and Wood's Northern, should be avoided in such localities.

On the eastern slopes of the Drakensberg, at an altitude of about 2,500 feet or lower, provided the rainfall is adequate and the soil suitable, late maturing sorts, such as the White Horsetooths, give a higher yield than Hickory King, and should prove equally suitable for use on the mines. For export purposes Yellow Hogan, Austin's

Colossal, Yellow Horsetooth, and Golden King may prove more satisfactory than the earlier maturing sorts mentioned above Of these four Yellow Hogan produces the best quality of grain; Golden King appears to be the least sensitive to drought, but the grain of the last named is apt to be dull in colour, giving an appearance of age to the sample, which is against it from a market point of view.

The conditions of climate and soil in the Transvaal are so varied that these recommendations only apply in a general way; no one can say definitely which breed can be grown to greatest advantage on any particular farm without knowing the exact conditions prevailing there. Even on broad lines it will be found that exceptions must be made to meet special conditions. A cross-bred form of Natal Yellow Horsetooth has been grown successfully, and to a very considerable extent, during several years, in parts of the Standerton District; though this cross is a good yielder, it is not a good strain to grow for export, as it is likely to be graded as "mixed," and to command a lower figure than if it were a pure strain.

Mixed maize, whether yellow and white, or flint and dent, is never likely to command as high a price as a pure breed of "F.A.Q." grade. Mixed yellow and white may be just as useful for stock feed as pure yellow or pure white, but it is not as suitable as the pure white for various manufacturing purposes, and the price suffers in consequence.

It is most desirable therefore for farmers to prevent the crossing of their maize crops. This can be done, to a large extent at any rate, by careful observance of the following suggestions:—

(1) Do not plant different breeds less than 400 yards apart.

(2) If this is impossible, plant late maturing and early maturing sorts side by side and at the same time, so that they may flower at different times.

(3) By planting two white breeds or two yellows together the two will cross if they flower at the same time, but the cross will not show in the first progeny, and the grain will be suitable for sale, though not for seed.

(4) Avoid planting one breed on land which carried another breed the previous year. With every precaution as regards second ploughing, cultivation, and harrowing, some "volunteers" from the previous crop will escape and pollen from them might spread through a whole field of 100 acres, more or less damaging the grain either for market or seed.

Varieties and Breeds now Grown.

The following six varieties of maize are found in South Africa. Yellow grained breeds are more common than whites; reds, blues, and blacks also occur, though sparingly.

1. *Flint Maize* (*Zea Mays*, var. *indurata*).

Recognised by the corneous (horny) endosperm enclosing the starchy endosperm (which does not reach the apex), as shown in a split grain, and which varies in thickness in different breeds. In the trade this is sometimes known as "round" maize. Sturtevant describes 69 different breeds of flints.

Most, if not all, the earliest maturing of the commercial breeds are of the flint variety; in many cases, e.g. the Cinquantino of Southern Europe, the growing season is so short (40 to 50 days) that only a very small amount of grain can be produced. As a rule, the flint breeds are relatively light yielders; perhaps the demand for dent maize having been greater than for flint has led to the cultivation of the latter mainly as a catch crop at the end of the season or in parts of the world where the growing season is too short for dents.

Yellow Flints.—Cango, Botman, and New England Eight-row are the breeds now grown almost exclusively in this class. The Bushman and Repatriation, occasionally met with, also belong here. The following have also been tested:—Compton Early, Canada Early (eight rowed), Vilmorin's Early, Vilmorin's Early (long eared), Henderson's Large Yellow, Ninety Day, Longfellow, Improved King Phillip, Harris' Golden, Cinquantino, Extra Early Szchely, Odessa, La Plata, Argentina, Early Small Yellow Auxonne, and Sheppard's Yellow Flint.

Red Flints.—Indian Pearl. The ears often carry white, red, and blue grains mixed.

White Flints.—Cango, Botman, and Rural Thoroughbred are the principal sorts grown. North Dakota, Western Beauty, and Burlington Hybrid are being tested. Egyptian has been tried and discarded.

2. *Dent Maize* (*Zea Mays*, var. *indentata*).

Recognised by the indentation (or "dent") at the apex and the presence of corneous (horny) endosperm at the sides of the kernel; the starchy endosperm extends to the apex. The corneous matter varies in height and thickness in different breeds; this determines the character of the indentation, which is caused by the drying and shrinkage of the starchy endosperm at the summit of the kernel, which is then drawn in or together.

The breeds of dent maize are far more numerous than those of any other variety. Sturtevant described 323 breeds in 1899, and many have been added since. In the United States they are more extensively grown than any others, furnishing nearly all the maize exported.

Yellow Dents.—The principal sorts grown are:—Yellow Horsetooth, Golden Beauty (more in Natal than the Transvaal), Golden King, Chester County Mammoth, Eureka, Yellow Hogan, King of the Earliest, Star Leaming, Bristol 100-day, and Austin's Colossal.

The following are still being tested experimentally:—White Cap, Extra Early Huron, Early Leaming, Minnesota 13, Reid's Improved, Riley Favourite, Early Butler, Droughtproof, Early Mastodon, Clarence River, and Iowa Goldmine.

The following have also been tried, and discontinued:—Waterloo, Extra Early, Hawkesbury Champion, Late Mastodon, Yellow Butcher, Wealth of Nations, King's Early, Pride of the North, Improved Leaming, and Legal Tender.

Red Dents.—Red Hogan has been tested, but does not seem to have been taken up yet.

White Dents.—Hickory King, Louisiana Hickory (ten rowed), Natal White Horsetooth, Hickory Horsetooth, Ladysmith, Iowa Silver Mine, Champion White Pearl, North American, and Boone County

(though more in Natal than in the Transvaal) are the breeds most largely grown here.

The following are also being tested:—Wisconsin, Wood's Northern, Improved Early Horsetooth, Red Cob Ensilage, Snow White, Virginia Horsetooth, Cocke Prolific.

The following have also been tested, but discontinued:—Late White Horsetooth, Mayfield Earliest, Silver King, Blount Prolific, Adam's Extra Early, Minnesota White, Ninety Day White, Champion of the North, Large White.

3. *Soft Maize* (*Zea Mays*, var. *amylacea*).

This variety includes the flour corns or bread mealies. It is recognised by the absence of corneous endosperm; the grain is soft, and does not keep well on account of weevil and grain moth. It is used both for meal and for "green mealies," but the feeding value is poor, both protein and fat-content being low. Two breeds are grown in South Africa, both white, viz., South African bread mealie and Brazilian. Tuscarora is being tested and Cuzco has been abandoned; red grains are met with in both of these. There are not many sorts of soft maize; Sturtevant describes only 27, some of which appear to be only colour forms of others.

4. *Sweet Maize* (*Zea Mays*, var. *rugosa*).

Well defined by the more or less crinkled, wrinkled, or shrivelled condition of the kernels and their translucent, horny appearance. Sturtevant describes 63 sorts.

The cultivation of sweet maize in place of the bread mealie and "field corn" for use as "green mealies" is slowly gaining ground, and seed can now be obtained from most seedsmen. Several breeds have been introduced, including Black Mexican, Crosby Early, White Cory, Landreth, Stowell Evergreen, Country Gentleman, Golden Bantam, and sweet fodder corn, the latter for hay and silage.

5. *Pop-corn* (*Zea Mays*, var. *praecox*).

Characterised by the exceptionally large proportion of corneous endosperm (in the best breeds it comprises the whole endosperm) and the small size of the kernels and ear.

The grain has the property of "popping," which is the complete eversion or turning inside out of the kernel through the explosion of the contained moisture on the application of heat. The presence of a small amount of starchy endosperm does not greatly interfere with the property of popping, but when a certain proportion is exceeded only the corneous portion explodes, leaving the starchy portion unchanged. Sturtevant describes 25 breeds. Golden and Rice pop have been introduced into South Africa.

6. *Pod Maize* (*Zea Mays*, var. *tunicata*). (Plate 85.)

In this variety each kernel is enclosed in a pod or husk; the whole ear has its usual coating of husks (that is, leaf sheaths). It is only cultivated as a curiosity, but ears of this sort are occasionally met with in fields of other varieties. It appears to have been introduced quite early to the African continent, for in 1623 Caspar Bauhin referred to its occurrence in Africa under the name *Manigette*.

The grain is small and very flinty, often with a sharp beak, and is said to be particularly resistant to weevils. Dr. Sturtevant notes

that once his whole collection of maize breeds (an exceptionally fine one) was destroyed by weevils, except the pod maize.

Relative Maturity.

No definite time limit for the ripening of the grain can be assigned to any variety or breed of maize; the time fluctuates with the season, according as it is wet or dry, hot or cold. Professor Morrow, of the Illinois Agricultural Experiment Station, notes the following differences in the ripening of Burr white dent:—

1888 in 135 days.
1889 in 144 and 156 days.
1890 in 130 days.
1892 and 1893 in 127 days.

Professor Burrill, of the same experiment station, notes the following difference in time of reaching edible maturity in Crosby Early sweet maize:—

1888 in 62 to 64 days.
1889 in 83 to 85 days.
1890 in 79 days.

The season does not affect all breeds in equal degree, but there is a relative proportion between their times of maturity which can be used for classificatory purposes and as a guide to the adaptibility of the different breeds to climatic conditions in different parts of the country.

Record has been kept at the Experiment Farm, Potchefstroom, of the relative time of ripening of the different sorts tested there, and the following classification is practically identical with that given by the general manager in his published annual reports. On an average Mr. Holm finds the different breeds would be sufficiently ripe to be safe from frost approximately as follows:—

Very early, in about 85 days from date of appearance above ground.
Early, in about 95 days from date of appearance above ground.
Medium early, in about 110 days from date of appearance above ground.
Medium late, in about 125 days from date of appearance above ground.
Late, in about 140 days from date of appearance above ground.
Very late, in about 150 days and over from date of appearance above ground.

Relative Yields.

"Variety tests" to determine the relative yield of different breeds under exactly similar conditions of soil and climate have been conducted for five consecutive years on the Government Experiment Farm at Potchefstroom, and the comparative results will probably be published by the general manager when the present season's crop has been fully harvested.

It is instructive to note the difference in relative yield in different years. For example, Hickory Horsetooth ranked first in yield in 1905-06, but fell to the sixteenth place in 1906-07. Such variation may be due partly to greater or less susceptibility to change of weather as regards drought and moisture, sunshine and cloud; it may also be due to change in the plant itself in adaptability to new environment.

e.g., a newly introduced sort may not give the best returns for the first few seasons after its removal to a different climate or soil. Continuous variety tests under uniform conditions and treatment are necessary for the accurate determination of the relative merits of different breeds of maize.

Descriptive Notes on the Breeds.

In preparing the following notes on the breeds it has been found undesirable to give actual height of stem, yield of grain, length of time required to reach maturity, etc., inasmuch as these characters are subject to variation from year to year, according to season, difference in soil, or difference in altitude. Nevertheless, there is a mean or limit to the range of variation in these characters which may be considered typical of the breed, and which may be used in defining the distinctive characters of each. For the present it is best to make use of somewhat general comparative terms, the exact limits of variation under all conditions in this country being unknown.

Early Sorts.

1. *White Botman.*—Early white flint; stem tillers, leafy below; less robust than White Cango, but earlier; yield medium. Grain small, pearly white. Grown originally from local seed. Suitable for planting at the end of the season for other breeds. Widely grown.

2. *Rural Thoroughbred* (1546.05, Thorburn).—Early to medium early white flint; yield fair. Grain of good quality. Originally received from Thorburn, of New York, under the name of "Thoroughbred White Flint," but there is nothing about it by which we can distinguish it from the standard white flint known as "Rural Thoroughbred." It succeeds well at Standerton.

3. *Australian Ninety-Day* (1041.04, Sheppard).—Early yellow flint; yield fair. Grain small, orange yellow, of good quality. Leafy plant of rather stronger growth than other early breeds; good drought resister. Originally received from New South Wales; must not be confused with the "Ninety-Day" of the United States, which is a yellow dent breed. Reported as having matured in 100 days in the Pretoria District; has also done well in the Wakkerstroom District.

4. *Chester County Mammoth* (1471*b*.05, Henderson).—Early yellow dent. Ears very well packed with grain; yield good; grain medium size, long and wedge-shaped, suitable for the export trade; good drought resister; recommended for districts with short growing season; does well at Standerton and Vereeniging. Excellent reports of it received from the Witwatersrand, Pretoria, Bethal, Wakkerstroom, and Marico Districts.

5. *South African Bread Mealie* (697.04, Moody).—Early white flour corn; tillers freely; yield rather poor; grain soft, soon injured by weevil and grain moth; feeding value is low, grain being poor both in protein and fat. Used both for meal and for "green mealies"; for the latter purpose it is excellent owing to its good flavour. Widely grown, but only in limited quantities.

Medium Early Sorts.

6. *New England Eight-Row* (758.04, Burpee).—Medium early yellow flint; yield fair. Grain medium size, rich golden yellow, of

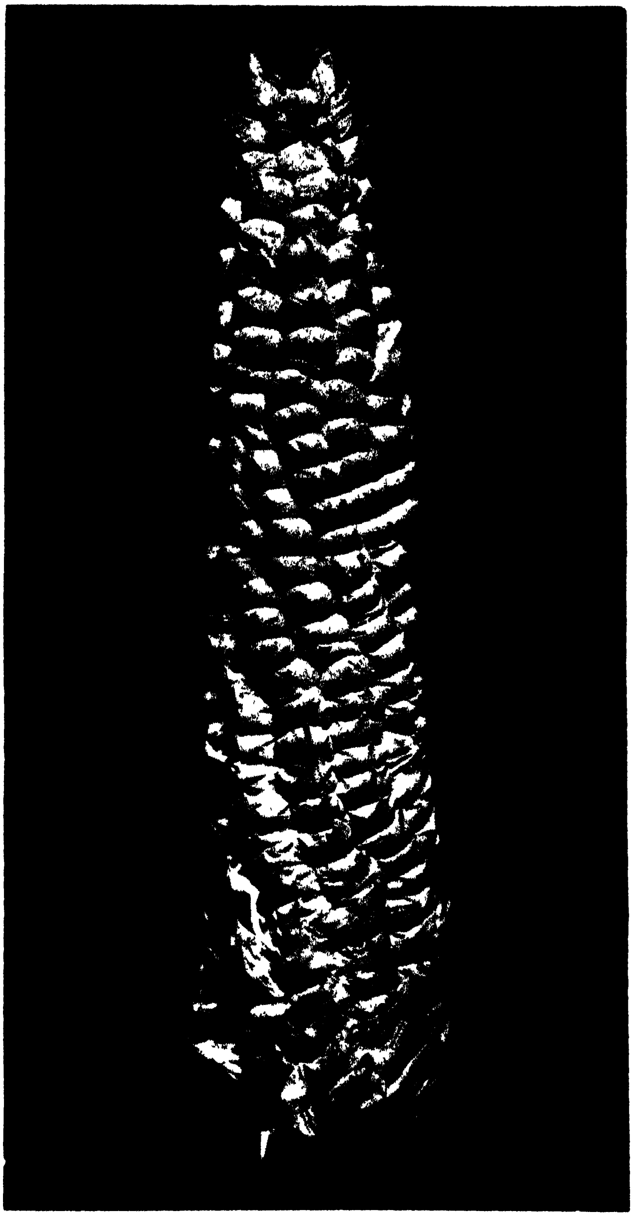

Plate 85.

Pod-Maize (*Zea Mays* var. *tunicata*).

An unprofitable type to grow.

Plate 86 Interior view of Selection Room of Devon Farm Bacon Factory, showing hams, bacon and fresh pork. These are ideal productions.

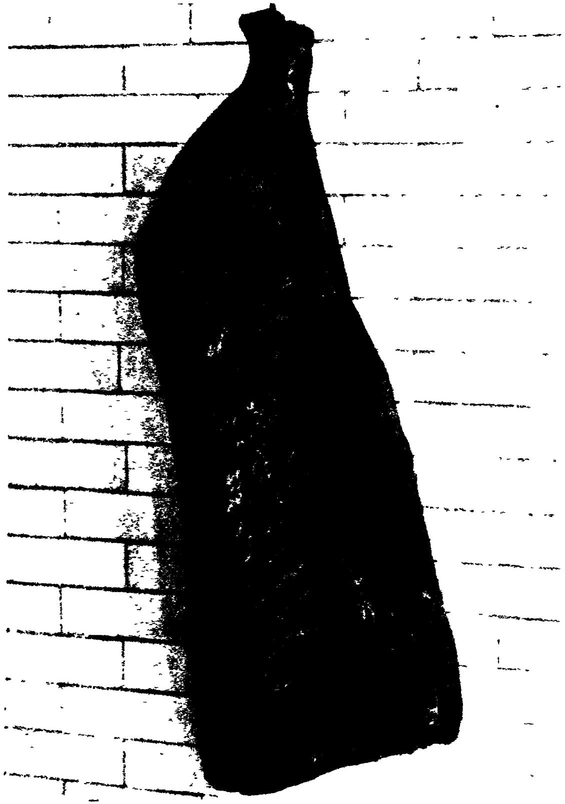

Fig. 1

Fig. 2

Plate 87

Fig. 1 Three-quarter side of Smoked Bacon of prime quality cured on Devon Farm
Fig. 2 Pale-dried Matured Ham

Plate 88

Deposit of Hailstones, 17th October, 1906.

As seen from Government Observatory, Johannesburg, looking northwards. The hail totally ceased along a straight line about 1,000 yards north of the photographer.

good quality; suitable for stock feed and for export. Plant tillers; good drought resister; one of the best of the flints.

7. *Indian Pearl* (639.03, Vilmorin).—Medium early red flint; yield good. Grain small, roundish, of high feeding value, mixed (red, purple, blue, or pearly white), on the same or on separate ears. Plant tillers freely, and is very leafy; especially suitable for fodder, hay, or silage.

8. *White Cango.*—Medium early white flint; yield fair. Grain rather large. Plant tillers freely. Useful for late districts. Original seed obtained locally. Extensively grown throughout the country.

9. *King of the Earliest* (748.04, Burpee).—Medium early yellow dent. Ears very well packed with grain; yield fair. Grain wedge-shaped, horn orange, with a yellow cap; suitable for the export trade. Recommended for districts with short growing season. Excellent reports of it have been received from the Middelburg, Barberton, Ermelo, Standerton, and Heidelberg Districts.

10. *Bristol 100-Day* (1218.05, Henderson).—Medium early yellow dent. Ears very well packed with grain; yield good. Grain medium size, long, thick, yellow, with white cap; suitable for the export trade.

11. *Star Leaming* (1043.04, Sheppard).—Medium early yellow dent. Ears well packed with grain; yield fair. Grain of medium size, thick, of good quality; suitable for the export trade. A useful sort for districts of short growing season. Succeeds at Standerton.

12. *Eureka* (1470.05, Henderson).—Medium early yellow dent. Ears long and well packed with grain; yield good. Grain medium size, rather long, wedge-shaped, of good colour and quality; suitable for the export trade. A good drought resister. Succeeds well at Standerton and Vereeniging.

13. *Champion White Pearl* (1448.05, Thorburn).—Medium early white dent. Yield good. Grain medium size, thick, of good quality for meal; suitable for the mines' trade. Fair drought resister. Recommended for the eastern high veld; does very well at Standerton and in the Wakkerstroom, Ermelo, Heidelberg, and Pretoria Districts.

Medium or Mid-Season Sorts.

14. *Yellow Cango.*—Medium yellow flint. Ears long and well packed with grain; yield fair. Grain medium size. A robust, leafy, tillering plant, resisting drought well. Original seed obtained locally. Extensively grown throughout the country, but now rarely met with in a pure state. Valued for making mealie hay.

15. *Iowa Silver Mine* (1547.05, Thorburn).—Medium white dent. Ears short, but well packed and yielding well. Grain medium size, wedge-shaped, thick, of good quality for meal; suitable for the mines' trade. Plant fairly drought-resistant; proves well adapted to the eastern high veld, where it is being grown on an increasingly large scale. Gives excellent results in the Standerton and Heidelberg Districts.

16. *Wisconsin* (1446.05, Thorburn).—Medium white dent. Ears rather small, but well packed with grain, and yield fair. Grain rather small, white; suitable for meal. Said to be a good drought-resisting sort.

17. *Wood's Northern* (1472*b*.05, Henderson).—Medium white dent. Ears long and well packed with grain; yield fair. Grain

medium size, wedge-shaped, of good quality for meal; suitable for the mines' trade. Has been a great success in the Heidelberg District and (this season) in the Wolmaransstad District.

Medium Late Sorts.

18. *Louisiana Hickory* (10-row), (532.03, Altenroxel).—Medium late white dent. Ears rather short; yield fair. Grain large, but narrower than in the 8-row type, of good quality, and excellent for the mines' trade if well grown. Hardy and fairly drought-resistant. The principal form of Hickory King met with throughout the country. Suffers from frost on the extreme high veld.

19. *Hickory King*, (true 8-rowed type), (533.03, Moon).—Medium late white dent. Ear rather small; yield fair. Grain large, as broad as long, of good quality. A hardy, fairly drought-resistant sort, of which the grain is in some demand in Europe for manufacturing purposes. This trade should be carefully fostered by the production and export of uniform grain of high quality. Suffers from frost on the extreme high veld.

Late Sorts.

20. *Yellow Hogan* (766.04, Sheppard).—Late yellow dent. Ears long, well packed with grain; yield good. Grain wedge-shaped, thick, heavy, and of good quality: suitable for the export trade. A good sort for early growing. Seed originally obtained from Australia. Does well at Vereeniging; favourably reported on in the Standerton and Barberton Districts.

21. *Golden King* (1782.05, Andersson).—Late yellow dent. Ears large, yielding well. Grain large, resembling Hickory King in shape; reddish yellow, shading to yellow, but apt to be dull in colour; feeding value comparatively low. An Australian breed. A hardy drought-resistant sort for the warmer parts of the country. Suffers from frost on the extreme high veld; much grown in the warmer districts; favourably reported on in the Barberton, Waterberg, Marico, and Potchefstroom Districts.

22. *Austin's Colossal* (1786.05, McNally).—Late yellow dent. Ears large, well packed with grain; yield good. Grain rather small, thick, long, light yellow, with lighter cap. Plant vigorous; a good yielding sort for early planting in districts with good rainfall or for altitudes below 4,000 feet with long growing season, but not recommended for the high veld nor for the western districts, though it has done well this season near Maquassie. Favourably reported on in 1906-07 in the Middelburg and Barberton Districts, and at Pietersburg and Tzaneen.

23. *Hickory Horsetooth*.—Late white dent. Ears large and well packed with grain; yield good. Grain large, broad, wedge-shaped, of good quality; suitable for the mines' trade. A robust, promising sort for districts with long growing season; a good drought resister. Does well at Potchefstroom.

24. *Virginia Horsetooth* (1447.05, Thorburn).—Late white dent. Ears long and well packed with grain; yield good. Grain large, long, and narrow, of good quality for meal; suitable for the mines' trade. A good sort for districts with good rainfall and long growing season.

25. *Ladysmith* (*ex Natal*).—Appears to be a strain of Virginia Horsetooth. Does well at Vereeniging if planted early.

26. *North American (ex Natal)*.—Appears to be a strain of Virginia Horsetooth. Has done well this year near Potchefstroom. We had favourable reports on this variety in 1906-07 from the Wakkerstroom District.

27. *Brazilian Flour Corn* (536.03, Thorburn).—Late white flour corn. Ears medium; yield fair. Grain small, of poor feeding value, both protein and fat-content being low. A very leafy sort, tillering freely, and suitable for silage. Favourably reported on in the Heidelberg, Lydenburg, and Wakkerstroom Districts.

Very Late Sorts.

28. *Yellow Horsetooth*.—Very late yellow dent. Ears long and well packed with grain; yield good. Grain broad, heavy, golden yellow, but often dull in colour. Much grown in the Standerton District, above 5,000 feet altitude, but the strain usually met with is much crossed with a yellow flint, and, in consequence, it continues to "split up" into dents and flints from year to year.

29. *Natal White Horsetooth (ex Natal)*.—Very late white dent. Ears large and very thick, well packed with grain, but cob excessively thick; yield good. Grain thick, wedge-shaped; suitable for the mines' trade. A heavy cropper where the season is suitably long and rainfall adequate. Gives the lowest percentage of grain to cob of almost any breed grown, but is one of the best in yield per acre. A profitable sort at Vereeniging when planted early.

Mixed Farming in Devonshire.

By Loudon M. Douglas, Lecturer on the Meat Industry, Edinburgh; Editor of "Douglas's Encyclopædia for Bacon Curers," etc.

The county of Devon is celebrated in England as being one which carries a larger proportion of cattle to the total acreage than any other. Its area runs to 1,666,839 acres, and in 1907 cattle of all sorts numbered 296,965. Three-quarters of the county is under cultivation, and more than half of this is permanent pasture.

The principal cattle which are kept in the county belong to the well-known Devon breed, and these have now become famous throughout the world as producing the best dual purpose cows. At one time the red Devon cattle were used as draught oxen, but for many generations they have been exclusively kept because of their beef and milk-producing qualities. It is, however, a custom amongst the better class of farmers to use also some Jersey cattle in order to increase the creaming qualities of the milk produced.

In this conection there are few farms in Devon, or, for that matter, anywhere else, which would compare with that owned by Messrs. Loram Bros., who trade as the Cathedral Dairy Company, Exeter, and at Rosamondford, Aylesbeare, Devon.

The great advantage of this farm is that it is utilised for dairying purposes; it also possesses a creamery, and the by-products from the milk are utilised to feed pigs. Hence there is a pig breeding establishment, and in order to complete the process there is also a modern bacon factory, so that the best possible use is made of all the products.

The farm extends to 420 acres, and really is composed of two farms, namely, Rosamondford and Rill. They are about seven miles from Exeter, and lie in the great pasture area between that city and Ottery and Sidmouth.

The land of the farms is composed of red clay, and is stiff, and therefore capable of holding a large amount of moisture, which is an element in dairy farming not to be neglected.

The farm is carried on primarily for the dairy, and a succession of grain crops is produced. Trifolium and rye grass are grown in early spring; in the late spring vetches, clover, and maize are planted, and these carry the stock through until the winter, when roots become available, swedes being grown for the early winter before Christmas, and mangels for late winter and early spring.

It is customary to pass everything through the chaff cutter and root pulper, and no long fodder is fed, all the food, including roots, being mixed before being given to the cattle, and the same principle applies to the feeding of the pigs. The corn is cooked in winter, and a mixture of beans, maize, and wheat grains is fed to the cattle morning and evening along with chaff and roots.

The cattle consist of one herd of Jerseys and two herds of red Devons, and are chosen because of their milking qualities, for clotted cream.

Records of the milk yield are kept morning and evening, and the quantities are weighed once a week. Cows which give under 600 gallons per annum are eliminated from the herds, and it is curious to note that some of the cows give 900 to 1,000 gallons, and these are common to both breeds kept. The rich colour of the cream is, of course, derived from the Jerseys.

One of the features of the farms is that grass land of 200 acres is given up to hay-making, yielding an average of about 350 tons per annum.

The treatment of the cattle is of considerable interest. They are turned out into the pastures, and remain out day and night from the first week in May until the middle of November, then they are taken up at night, but go to the pastures during the day. They are, therefore, on the pastures every day all the year round, which is an essential feature, so that they can have sufficient exercise.

There is plenty of water on the farms, which is derived from streams. The rainfall averages about 32 inches per annum, so that the conditions are as well as they could possibly be.

The work of the farm is carried on by eight horses, and a two-horse wagon is used daily to carry the milk to the central distributing depot in Exeter.

As has been mentioned, the principal business is the production of Devonshire clotted cream, and in this respect these farms are celebrated inasmuch as the dairy produces the largest quantity of clotted cream of any one farm in the United Kingdom.

The process of manufacturing clotted cream has been described as follows :—

"The principal part of clotted cream-making lies in the scalding and cooling. The milk is brought in and immediately placed in flat tinned vessels holding easily two gallons each. The milk is "set" in these pans. The pans are then placed in a hot water bath, capable of taking a great many at a time. They are immersed almost to the rim, fitting exactly into openings in the bath. The water is heated by means of a steam coil, and the milk is not raised above 180° Fahr. This heating continues for a quarter of an hour, and, of course, much of the fat rises to the surface, but all of it does not do so until the cooling process begins. The pans are placed in a large, well-ventilated room, and as their contents gradually cool, the almost total separation of the cream takes place, nearly all of it rising to the surface. When the normal temperature is attained it will be observed that a thin film covers the top of the cream, and seems to bind it together. This film may be some trace of casein forced to the top, but in any case it acts as a binder in such a way as to enable the cream to be set in dishes firmly. When cold, the cream is skimmed off by means of a strainer and placed in separate dishes, when it is ready for use. The whole process is a simple one and does not involve much skill. It is necessary, of course, to exercise great care in having all the vessels quite clean. The heating should be done quickly as indicated, and the temperature should not exceed 180° Fahr."

Devon and Cornwall have, from time immemorial, had the monopoly of the clotted cream industry, and attempts to produce the same product elsewhere have not been successful. It is said that the business began in the time of the Phoenicians, who came to Cornwall and Devon in search of tin, and brought with them the utensils used in the East for making clotted cream, and with very little variation the same processes as used by them are carried out to the present day. The banks of the Tamar have

many classic relations, but none better known throughout the world than those associated with Devonshire cream :

"Oh, nothing on earth or in poet's dream
Is so rich and rare as your Devonshire cream,
Its orient tinge like spring-time morn,
Or baby buttercups newly born ;
It's balmy perfume, delicate pulp,
One longs to swallow it all at a gulp,
Sure man had ne'er such gifts or theme
As your melt-in-the-mouthy Devonshire cream."

The creamery, besides producing Devonshire cream, is also utilised as an ordinary butter factory, and possesses the usual equipment, that is to say, it has a scalding tank, pasteuriser, coolers for water and in connection with them a refrigerating machine. Whatever surplus milk is not utilised in the manufacture of clotted cream is devoted to the manufacture of butter.

The refrigerating machine which is used is of the Douglas type, and the refrigerating agent is the low pressure sulphurous-anhydride, which is so adaptable to dairy purposes owing to the fact that it is easy to control and takes very little power to work it.

The whole creamery is a complete illustration of what may be done on an ordinary farm, and in itself would be a complete business.

The utilisation of the by-products, however, has forced itself upon Messrs. Loram, and it occurred to them that while their large depot at Exeter could dispose of butter and cream, there seemed no reason why it could not also dispose of bacon and pig products from the farm, and for this reason it was decided some years ago to adapt a large portion of the farm to the breeding and fattening of pigs, with a view to utilising the separated milk and ultimately producing bacon. As a matter of fact, they were driven to this course in order to utilise this by-product successfully. Hence we find that to-day a regular stock of 200 pigs is kept, and there is also a breeding establishment with twenty-four breeding sows, from each of which five litters in two years are obtained. The varieties are Middle York, Berkshire, and Large Black. The parents are pure bred, but the progeny are crossed : white on black, and black on white, boars of each breed being kept.

It is usual to feed the pigs in summer on milk and sharps, both breeding sows and growing pigs being fed in that way. For six weeks, however, before the pigs are slaughtered they are penned in and fed on milk and barley *ad lib.*, and also a ration of milk and sharps which has been sodden in a tub. A quart of cod liver oil is added for every twenty pigs, so as to restore the fat taken out of the milk. The pigs are matured at a dead weight of 180 lbs., and are cured on the Wiltshire system, that is to say, after the pigs are slaughtered they are scalded and cleansed. They are then split into sides and cooled, after which the sides are pumped with a recognised curing pickle, the pumping being greatest in the fleshy parts, namely, the gammon and shoulders. The bacon takes about fourteen days to cure, and is then ready for smoking, this being carried out by means of oak or other hardwood sawdust. The sides are then dried with the assistance of gill pipes, through which steam circulates, and may either be sent out in the dried state or smoked. The products of the factory are : sides, three-quarter sides, middles, shoulders, and hams. The process of curing is that which is generally carried on in other bacon factories, with

the exception that the sides are usually cured for five days in pickle to which certain condiments have been added. Hams, of course, take somewhat longer to cure, and have to be treated rather differently, but the main part is practically the same as with bacon-curing. All these products are disposed of in the Exeter depot, and an increasing business is being done from year to year. It has also been found that in the bacon factory there were a number of by-products, and, carrying out the principle which had first of all driven Messrs. Loram into the bacon-curing business, they also recognised that it was necessary to utilise these by-products in the same way. Hence there is a large production of sausages, hogs' puddings, and similar small goods, for all of which there is a ready sale. (See Plates 86 and 87.)

The plant in connection with the dairy and bacon factory was supplied by Messrs. William Douglas & Sons, Ltd., of Putney, London, who were also advisers to Messrs. Loram in the construction of the buildings.

Part of the farms is devoted to the growing of fruit, and there are considerable orchards, from the fruit of which it was the custom at one time to make cider. Recently, however, it has been decided, with considerable success, to utilise the fruit of the farm for preserving. Hence large quantities of raspberries, currants, plums, apple jelly, etc., are produced and sold in bottles, all of them being packed, with the exception of the jellies, in a light sugar syrup. The bottles are stood in a Douglas canning vat for twenty minutes, so as to render the liquid sterile, and after such treatment the fruit will keep for an indefinite period.

It will thus be seen that these Devonshire farms are utilised up to the hilt, there being no waste of any sort permitted, and their great success is doubtless due to the fact that the best possible use is made of every product. It is an object lesson which may well be copied in many countries, and is certainly one of the best which could be taken from the United Kingdom.

Hailstorms.

By Mr. H. E. Wood, M.Sc., Chief Assistant, Transvaal Observatory.

Hailstorms occur chiefly over the warmer regions of the globe, and most frequently in those countries where the rainfall takes place during the summer months of the year. Thus the Transvaal, which has a sub-tropical climate and a summer rainfall, experiences a considerable number of hailstorms during its rainy season. Hail is simply frozen rain, and although it may seem remarkable at first sight that frozen rain should fall more frequently in hot countries than in cold countries, the theory of its formation shows that this is to be expected.

It must be a matter of common experience that the temperature of the atmosphere decreases rapidly upwards; thus the low veld of the Transvaal is considerably warmer than the high veld of the Transvaal and the Orange River Colony, and this region is in turn warmer than the high mountains of Basutoland. It has been established as an experimental fact by balloon and kite ascents that the temperature of the air decreases by about one degree Fahrenheit for every 300 feet of elevation. Hence, although the temperature of the air near the ground may be about 60°, at an altitude of 9,000 feet above this the temperature of the air may be below the freezing point. Therefore, if there is any water vapour present in the atmosphere at this height it must be in the frozen state. The cirrus or feathery clouds frequently seen in our skies are at much greater altitudes than this, and they have been proved to consist of frozen particles.

Another important fact to remember is that warm air is lighter than cool air, and so tends to rise in the atmosphere. Hence, in hot countries, the heating of the ground by the sun gives rise to ascending currents, which carry the moist air from the surface up into the higher regions of the atmosphere, where the temperature is lower. Here the cooling of the moist atmosphere causes the contained moisture to condense first of all into rain drops. Then, if the ascending current is strong enough—and it is for this reason that hailstorms are more frequent in hot countries, where often the ascending currents are very violent—the rain drops are swept higher still until they reach the height at which the temperature is below freezing point and there they are frozen into hailstones.

Thus, in its early stages, the hailstone is a rain drop which is carried up to great heights in the atmosphere, and there frozen solid. The hailstone may then fall, and as it passes through the moist and warmer atmosphere below it condenses more moisture on its surface. It frequently happens that the falling hailstone comes into another powerful ascending current, and it is carried up again into the freezing region where the condensed moisture on its surface becomes frozen. Thus the hailstone increases in size. It is in this way that the very large hailstones are formed by being swept up into the freezing region several times and on each occasion receiving an additional coat of ice. If a large hailstone is cut into two, it is frequently seen to be built up of concentric layers, the number of layers corresponding to the number of times the hailstone has been carried up into the freezing region before finally falling to the ground. Not all hailstones show this structure, as owing to collisions between themselves in the atmosphere they become broken up and have irregular shapes. Large hailstones are sometimes formed by a number of smaller ones fusing together, and these possess no regular structure.

The fall of hail is always associated with thunderstorms, but these storms are of a peculiar type, so that hail is not to be expected with every thunderstorm. In the case of a hail thunderstorm the flashes of lightning are exceedingly numerous, but the thunder is weak. The flashes occur between cloud and cloud in the sky rather than between cloud and earth, and the discharges are not severe. In most cases the hail falls at the beginning of a storm and is succeeded by rain. Occasionally there are several distinct hailfalls following one another in the same storm.

The fall of hail occurs, as a rule, only in one portion of the storm front, so that although a thunderstorm may sweep across an extensive tract of country, the hail may only fall in a narrow belt parallel to the storm-track. Generally the width of the hail-belt is about five or six miles, but frequently it is much narrower than this.

HAIL INSURANCE.

By Mr. R. T. A. Innes, Director, Transvaal Observatory.

One of the calamities which may overtake the farmer is a destructive hailstorm. Mr. Wood has pointed out in the preceding pages that hail occurs during thunderstorms, and as the Transvaal gets much of its ordinary rainfall from thunderstorms during the warmer months of the year, hailstorms are unfortunately not uncommon. Fortunately, however, hailstorms that really cause destruction are at any particular spot most uncommon. An analogy is furnished by a total eclipse of the sun. There are about two total eclipses of the sun every year, but it falls to the lot of few persons ever to see one in the whole of their lives.

The area covered by a destructive hailstorm is remarkably small compared to the area of the land, and so it will happen that whilst one farmer sees his crops cut to pieces his neighbours will escape damage.

For some years past the Meteorological Department has circulated postcards in English and Dutch giving a question form with reference to hailstorms, and in this way it has accumulated a considerable amount of information.

The heaviest hailstorm that the writer ever experienced occurred over the Witwatersrand on the 17th October, 1906. The size of the hailstones was that of a pigeon's egg; the noise of the fall was terrific, and for some time the ground was white with hail; yet the damage done was small; some peaches were knocked off the trees, and of the plums and peaches which did not fall many were scarred. Some windows over a greenhouse were broken. Although there was an evident loss of fruit, it was not too late in the season for fresh fruit to form, and, I believe, the produce of the trees was fully up to the average. Another striking fact was the very narrow limit of this great hailstorm. Plate 88 shows the view from the Transvaal Observatory looking northwards. It will be seen that the hail totally ceases along a straight line about 1,000 yards north of the photographer. The breadth of the belt did not exceed a mile.

This storm was one of a succession of hailstorms which occurred in different parts of the Transvaal between the 14th and 18th of the month. In all 129 reports were received by the Meteorological Department, but not one of these reported heavy damage.

The storm of thirteen months later, viz., 16th November, 1907, was more destructive. A series of violent hailstorms, remarkable for the large size of the hailstones, passed over the Colony between the 14th and 22nd of that month. In all seventy-three reports were received, and a considerable number of these notified that some damage had occurred, but at one spot, Rietfontein (Pretoria), the intensity of these storms reached a sudden maximum on a few farms and caused damage to the extent of £1,250. In looking over the reports of the Department, other cases of heavy damage will be found. The most alarming reports which the Department has received are of storms which have fortunately occurred in the low veld or other parts of the Colony where there are few inhabitants.

But hailstorms are impartial, and may occur anywhere in the Transvaal. There are theories that hailstorms affect certain localities more than others, but it is doubtful if this is really so. Hail is formed so high above the earth's surface that the land contours can hardly influence its formation, and once it begins to fall, it will do so in fairly straight lines. Hail generally occurs in hot weather. The worst hailstorms occur during spring (October, November, December) in the hottest time of the day, or between one o'clock p.m. and sunset. Hail at night or during the cold months is generally light, and does no damage.

In Europe, where bad hailstorms are not uncommon, a theory prevailed for some time that hail could be rendered harmless by cannonading the clouds. Governments took up the matter, and a great deal of money was spent and evidence collected. The almost unanimous result of it all is that the cannonading has no influence whatever.

In other countries the farmer can insure his property against destruction by hail. There are many difficulties in the way of insurance, one being the ease with which a farmer can quite honestly over-estimate the amount of damage he has suffered. In spite of this, it seems equitable that in cases where the destruction has been very heavy the farmer should be able to insure himself against a calamity that no human forethought can escape.

I have before me some particulars of the results of insurance against hail in the Canadian Province of Saskatchewan during 1907, which are repeated here :—

"The Hail Insurance Ordinance is administered by the Treasury Department, and the following information concerning hail insurance for the year is furnished by Mr. John A. Reid, Deputy Provincial Treasurer.

"During 1907, for the first time since Government hail insurance was instituted in the North-West Territories, a choice of rates per acre for premium and indemnity was offered to those taking insurance. Under the new plan of insurance it is provided that grain crops may be insured for either $3.00, $4.00, or $5.00 per acre, upon payment for full insurance of a fee of 11 cents, 15 cents, or 19 cents per acre respectively. Previously the maximum indemnity per acre for fully insured crops totally destroyed was fixed at the rate of $4.00, and the premium for insurance was 15 cents per acre.

"The business done during the year was somewhat in excess of the transactions of the previous season ; but the rate of increase was not nearly as great as is shown by a comparison of the figures for 1906 and those for 1905. The number of contracts for insurance was 1,572 in 1905, 3,464 in 1906, and 3,930 in 1907. The area insured—483,255¾ acres—was about one-third more than was insured in 1906, and nearly two and one-half

times the area insured in 1905. The proportion of the crop area insured was larger than in 1906; the proportion was slightly more than one-seventh in that year, and slightly less than one-sixth in 1907. In 1905 only one-eighth of the crop was insured.

"The area damaged was 102,619½ acres. In 1906 the number of acres damaged was 39,147, or about two-fifths of the area damaged in 1907. The damage to the insured crops in 1907 was four times as great as in 1905, and the percentage of the insured area damaged was approximately twice as great as in either of the previous years. The number of claims for indemnity was 773, a large increase over the number in 1906, when 424 claims were made, and a still larger increase when compared with 258 claims made in 1905.

"The season of 1907, therefore, affords abundant evidence of the practical utility of the Hail Insurance Ordinance in providing indemnity for the farmer whose crop is damaged by hail. During the year no less than 21¼ per cent. of the acreage insured was damaged more or less, and the indemnity paid amounted to $167,411.30. The average indemnity per acre paid was greater in 1907 than in either 1905 or 1906. The figures are as follows:—In 1905 $1.41, in 1906 $1.45, and in 1907 $1.63 per acre.

"Owing to the fact that the percentage of the insured acreage damaged was about twice as great as in either of the last two years, the average indemnity paid per acre of the insured crop was also about twice the amount paid in other years. In 1905 the indemnity paid per acre of insured crop was 17½ cents. In 1906 the indemnity averaged 15½ cents, and in 1907 it was 34⅔ cents per acre. The cost of administration for 1907 was 2½ cents per acre, an increase of ⅘ cent per acre over the cost of administration for the previous year, and nearly 1 cent per acre more than for 1905. The increase on the cost of administration in 1907 was due to the fact that insured areas in several localities were visited by as many as three or four storms during the season, which necessitated an examination after each storm. Examiners' fees and mileage constituted no less than $7,206.45 out of a total of $10,887.35 paid for expenses of administration.

"The result of the year's work shows undoubtedly a desire for a higher rate of indemnity per acre. Of a total area of 483,255¾ acres insured for the year, only 18,514 acres were insured at 11 cents per acre, the new low rate, as compared with 207,347¾ acres insured at 19 cents per acre, the new high rate; the remaining 257,394 acres were insured at the rate in force for years, viz., 15 cents per acre.

"It would appear, however, that these rates, high though they may seem to be, are quite inadequate, as the deficit for the year was no less than $101,543.54. So large a deficit per acre was exceeded only in Alberta in 1905, when they were confronted by a deficit of $27,779.80 on a total insurance of 62,634 acres. No less than 28 per cent. of the insured acreage was damaged in Alberta in that year."

This extract is very instructive. It shows that in Canada advantage is taken of the opportunity to insure. Yet circumstances so differ here that a different scheme of rates would be required.

Notes on Game Protection in the Transvaal.

By H. N. Devitt.

The object of the legislature of a country in passing laws for the preservation of the game within its borders is two-fold—firstly, to protect the interests of those of its inhabitants who indulge in this kind of sport, as well as the interests of those land-owners who look upon game as a means of replenishing their larders, and, secondly, to protect all game, or certain species, against extermination by human and other agencies.

When the voortrekkers came to this country they found game of all kinds in great abundance. The settlement of the country, the advent of railways, and other causes have led to a gradual reduction in the countless herds of buck and other fauna, so that to-day it is only in parts where conditions are the most favourable to their existence that even the better known kinds of antelopes and birds are found in any numbers. Of recent years the establishment of game reserves, in addition to those which existed in pre-war days, has been undertaken with apparently excellent results, so that there is no immediate danger of the extinction of those species now under Government protection.

The Statute dealing with this subject—Ordinance No. 6 of 1905 and its amendments—replaced prior Acts of Parliament passed after the war, and now, with the regulations framed under it, forms our law on the subject.

Under this law "game" means a number of birds and animals contained in a schedule appended to it. Part II of the Schedule refers only to big game, and contains the names of some of the larger animals and birds, such as the elephant, hippopotamus, eland, and some sixteen others.

From the general list of "game" birds there is one noticeable omission, namely, quail. Quite possibly these little fellows were left out on account of their migratory habits. It is well known that they only appear in the inhabitated portions of the Transvaal at certain times of the year, generally about January or February and after the heavy rains customary in those months. They are usually found in old lands, and seem to like the seeds of certain early ripening grasses which abound there. There does not appear to be any reason, other than the one advanced, why they were not included in the list. The majority of them disappear before the winter comes on, though one sometimes meets a few stragglers when out after partridge. Whilst speaking of migrants among birds there are several of the protected species which are known to come and go regularly. Pauw (gom-paauw), for instance, are never seen in some districts until the veld has been burnt off, when they arrive with annual regularity—no doubt in search of the dead insects left behind the burnt grass. This is not the case with the smaller species; it only applies, as far as I am aware, to the largest of the bustards.

The pretty little Namaqua partridges, so frequent in dry seasons in some parts, better known as "sand grouse" (though they are distinguished in the Game Law), are also migratory, coming over as they do in thousands from the Kalahari Desert to the water holes and spruits in the Transvaal during periods of drought. I have occasionally come across solitary pairs at other times, but they are not found, as a rule, except as above stated. In the winter of 1903 thousands of these birds could be found for miles along the Vaal River. They stayed about a month, and then all of a sudden disappeared.

Ducks and geese are also said to be migratory. In some cases there is no doubt as to this, but in other cases again it is doubtful. As regards duck, it is somewhat difficult to discover where the different species go for breeding purposes. There is no doubt but that some breed in other latitudes, while others breed with us. In some low-lying parts of the country duck and teal appear to arrive about July, with the exception of the black river-duck, which appears to be a permanent resident. Some sportsmen think they only come down from the high veld pans, others say they come long distances, from as far as Lake Ngami and other large waters. In the high veld it seems that when the pans are full duck and geese are plentiful; when the pans are low, the reverse is the case.

Other omissions from the list are wild turkeys and snipe.

The open season until recently was from the 13th April to the 1st of September; this year it has been changed to four days earlier at each end; it opens, therefore, on the 9th of April in the case of most districts. One frequently heard the opinion expressed that the former period was unsuitable, and this view seems sound when one compares one's experience with that of other sportsmen. Of course, it is necessarily a most difficult thing to fix a season that will suit all parts of the Transvaal, differing as they do in climatic and other conditions, and especially to fix one that will suitably apply to all the species of game sought to be protected. Take the case of one of our commonest game birds—the partridge. It is unquestionable that the young birds are not, in the majority of districts, fit for shooting before the 1st of May, if then. They pair off again before the end of August, and a substantial shortening of the season, would, therefore, appear to materially improve their prospects. One frequently shoots birds towards the end of the season with eggs in them. A full-grown covey in April is the exception; on the other hand one often puts up little beggars just able to fly. My experience is that the warmer the veld the later the partridge.

Knorhaan seem to breed somewhat earlier, though the other day a man with whom I was out shooting winged a yound bird—one of the black species—the size of a chicken, of six weeks of age.

Of the smaller buck, steenbok and duiker seem to breed pretty well all the year round, as they are occasionally shot when heavy in lamb before the close of the season. One hears it advanced that females should be protected. This, if it could be carried out in practice, would be most desirable, but the sporting and practical reader will agree that such a rule would be most difficult of application. One would require to be very well versed in veldmanship indeed to be able to tell at a glance, and in the haste and excitement of the chase, whether every buck as it jumped up, in daylight or gloaming, was a male or a female.

The protection of hares seems to be doubtful wisdom, as they do so much damage to farm and garden crops. They may sometimes be turned up in the streets of our villages, and in some localities they are very plentiful. Another destructive creature is the spurwing goose (wilde makouw), and guinea-fowl are well known for their depredations in cultivated lands.

Under the law the eggs of game birds (including wild ostriches) may not be interfered with except under a permit to be obtained from the Colonial Secretary. It is also prohibited to export game, dead or alive, except under similar permit, which must also be obtained to allow of the removal of hides and horns, under certain circumstances, from the Colony. The regulations provide for the payment of rewards by the

Government for the destruction of certain alleged game-destroying animals, called vermin, such as lions, wild dogs, baboons, various species of jackals, and wild cats. These may be poisoned, if the poison be not used in the open season. Persons are prohibited from setting traps and snares for game and from coursing with dogs, except that in the latter case they may receive permits to do so upon Crown lands from the Resident Magistrate of the district. The Colonial Secretary has power to authorise certain approved persons to hunt game for scientific purposes in certain areas, and he also appoints such wardens, rangers, and native police, and such other persons as are required to supervise the game reserves. These officers have wide powers under the regulations in order to better control the preservation of the game under their care.

Under the Act itself the owner, occupier, or cultivator of land may destroy game thereon which is damaging the crops or trees, without any licence and at any time of the year in or out of season. This is a most necessary provision, especially in the case of springbuck, in some parts, providing it be not abused.

Punishment under the Act can only be inflicted by a Court of Resident Magistrate, with an appeal to the Supreme Court. The maximum fine is one of £100, or, in default of payment thereof, imprisonment with or without hard labour for a period not exceeding six months. The law also says that a sum of money, not to exceed half the fine imposed, may be paid to the informer upon the conviction of an offender.

Nowadays, as is well known, very few if any of the species known as "big game" is found in any of the more largely populated areas of the Colony. The shooting of the average townsman, and most other people as well, is therefore perforce confined to the smaller fry. From time to time the Government create "Royal" game of such kinds as bid fair to become extinct owing to their scarcity.

The average farmer does not care for bird-shooting, and usually confines his attentions to buck. Where certain classes of buck have been protected year by year the value of restrictions has become apparent. As regards its destruction, I think one may fairly attribute it in the Transvaal to the following chief causes, arranged in order of importance:

(A) *Natural Causes.*—
- (1) Excessive rainfalls.
- (2) Natural enemies.
- (3) Grass and bush fires.
- (4) Diseases.

(B) *Human Agencies.*—
- (1) Natives and native dogs.
  - (*a*) Individuals.
  - (*b*) Hunting parties.
- (2) Europeans.
  - (*a*) Licensed.
  - (*b*) Unlicensed.

From the foregoing it will readily be seen that there is much to militate against the increase of game in the Colony. Of the causes given some do not apply, or rather do not occur regularly, while others again are more frequent in one district than another. (A) (1) Of the natural

causes, it is rarely that rain falls in such quantities as to have a detrimental effect on the eggs and young of birds. (2) In natural enemies some districts abound, and in others such are rare. Of these, wild dogs, jackals, and hawks are the most destructive. (4) As regards diseases, the rinderpest in 1906 destroyed thousands of buck. There are believed to be other maladies affecting the feathered branch.

(B) (1) Of the human agencies, natives in some areas do a great deal of damage to the game. In areas which are practically inaccessible, or where the new Dog Tax Act has not been strictly applied, the kaffir lurcher is still a power for evil in the way of game destruction. When the natives organise hunts, as they still do in some of the more remote parts of the country, it means sometimes a hundred or so young bloods turning out armed with kerries and assegais, who sweep the country around their kraals in the shape of a V. They have dogs with them, and sometimes light the grass in front of them, sweeping up towards it. The chances for any small buck are consequently remote. (2) As regards Europeans, probably the greatest destroying agency is the shooting party whose sole object is to get a bag; these good people destroy more game in a week than twenty other people. For the proof of this one need only visit their laden wagons or carts, or occasionally one sees the result, or more correctly, a portion of it, depicted in a photograph appearing in some weekly newspaper. The portions that one does not see are those buck which have got away wounded, and which are many.

The causes for increase are, of course, either natural or by means of protection. One sometimes hears it stated that regular shooting among partridge has a favourable effect, in that it tends to reduce the number of cock birds. It is difficult to say how much truth there is in this belief.

Under the rules issued for the guidance of Magistrates regarding the issue of permits to shoot on Crown land, the issuing officer has power to limit the amount of game to be shot under it, at his discretion. If farmers and private owners were to issue permits in like manner, and make a small charge for them, it might have a good effect. The same applies to the large land-owning companies. The latter, however, with commendable foresight, have gone a step farther than others, and now, I believe, issue permits over their areas. No doubt but that as time goes on the private man will do the same, and wanton destruction, as distinct from and opposed to legitimate (in the ordinary sense of the word) shooting, will be put down with a firm hand.

Of course, if reserves and preserves would keep up the supply for the whole country, it might be a different matter, but where the game is apparently on the decrease all round, and the population increasing, there can only be one ending, namely, an almost entire depletion of what remains of those most beautiful and useful animals with which the high veld of the Transvaal once abounded.

The Chemical Section.

I. MANURIAL EXPERIMENTS WITH MAIZE.

By R. D. Watt, M.A., B.Sc., F.C.S., N.D.A. (Hons.), N.D.D.

Readers of the *Journal* will doubtless remember an account of certain experiments with maize and cowpeas recorded in the last July number. The experiments in question were carried out on poor sandy land at Koedoespoort to the east of Pretoria, with a view of ascertaining the effect of different artificial manures on these two crops. The effect of the various fertilizers on the cowpeas was not very marked, but the results with maize (mealies) were very striking indeed. The plot, which had received a dressing of superphosphate and nitrate of soda gave a yield of grain eleven times as great as that on the unmanured plot. From a financial point of view, however, the experiment was not a success, as all the different manures except one cost more than the value of the resulting increase in the maize crop. The opinion was then expressed that the residual value of the manures (that is the effect of the manures on the following crop) would be considerable, and that, taking the increased crop in the two years into consideration, a profitable result might be shown on some of the plots at least.

In order to test this point maize was grown on the same plots this season without any further addition in the way of manure or fertilizer. Pegs had been left in to mark off the plots, but even if this had not been done there would have been no difficulty in locating the various plots owing to the great differences in growth made on the differently manured sections. These differences were very evident early in February when a visit was paid to the farm, and were still more marked towards the end of March when the accompanying photographs were taken (Plates 89 and 90). The plots which had received superphosphate or basic slag stood out in marked contrast to those which had received no phosphatic fertilizer.

The following table gives a brief summary of last year's results with maize:—

Table showing Results of Experiments with Maize in 1908.

Plot	Manurial Treatment	Yield of Grain per Acre	Increase due to Manuring.	Value of Increase at 10s per 200 lbs.	Cost of Manure.	Gain or loss through Manuring
				£ s. d.	£ s. d.	£ s. d.
I	No Manure	120 lbs.	—	—	—	—
II	Lime	200 ,,	80 lbs	0 4 0	0 14 0	loss 0 10 0
III	Sulphate of Ammonia ...	220 ,,	100 ,,	0 5 0	1 8 8	,, 1 3 8
IV	Nitrate of Soda	Spoilt—a poor crop	—	—	—	—
V	Basic Slag	280 lbs.	160 ,,	0 8 0	1 7 8	,, 0 19 8
VI	Superphosphate	360 ,,	240 ,,	0 12 0	1 10 8	,, 0 18 8
VII	Sulphate of Potash ...	545 ,,	425 ,,	1 1 3	1 8 10	,, 0 2 7
VIII	Superphosphate and Nitrate of Soda	1,345 ,,	1,225 ,,	3 1 3	3 0 6	gain 0 0 9

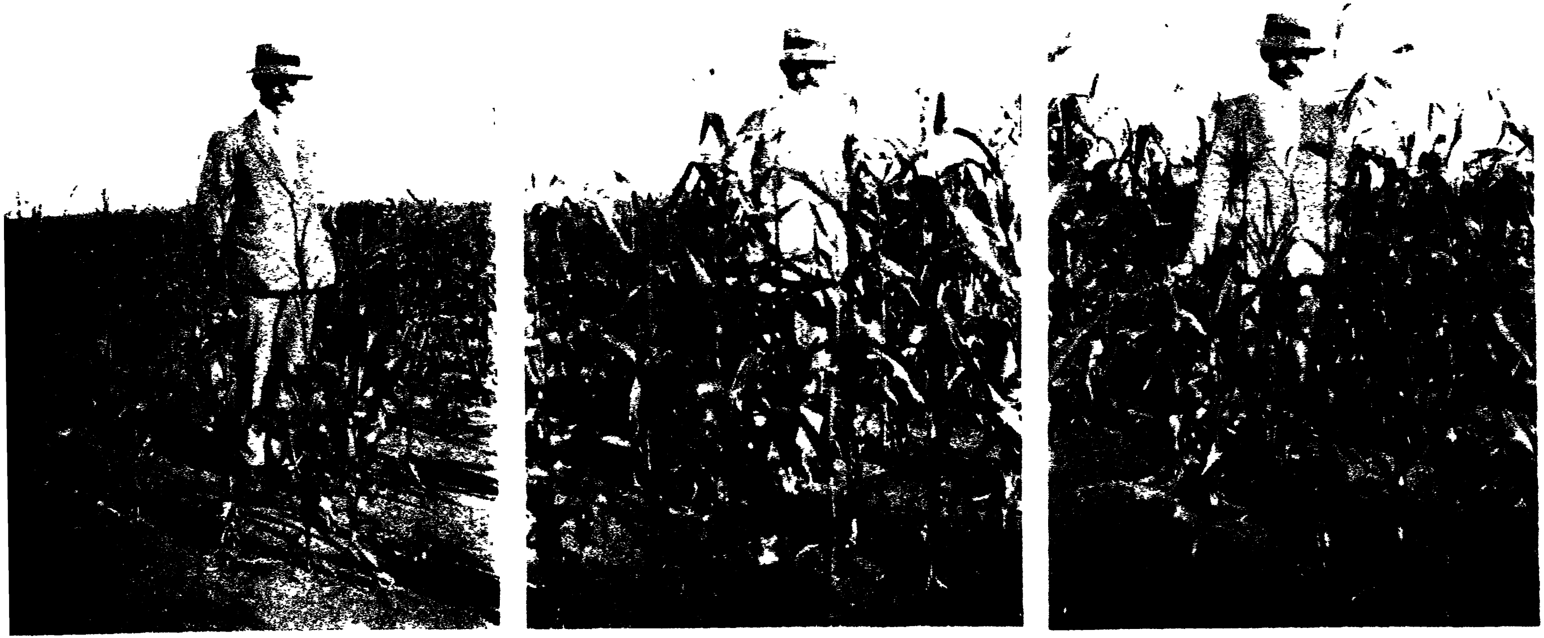

Plate 89. 1. No Manure. 2. Superphosphates. 3. Superphosphate and Nitrate of Soda.

Showing the effect on Maize of Manures applied to the Previous Crop.

1933

Plate 90. 1. Sulphate of Ammonia 2. Sulphate of Potash. 3. Basic Slag

Showing the effect on Maize of Manures applied to the Previous Crop.

The results obtained last year with cowpeas are hardly worth recapitulating as the increases were so small, the greatest being 1,260 lbs. of green forage, or 350 lbs. of hay per acre on the most heavily manured plot.

One fact was every evident from the appearance of the crop this year, namely, that the strip on which cowpeas were grown last year was much better all along than the strip on which maize had been grown, and these differences are well shown in the actual yields obtained this year. The following is a summary of the yields this year:—

Plot.	Manurial Treatment 1907-08.	Manurial Treatment, 1908-09.	After Maize. Yield of Maize per Acre 1909.	After Cowpeas. Yield of Maize per Acre 1909.
I	No Manure...	No Manure ...	200 lbs.	360 lbs.
II	Lime ...	,, ...	290 ,,	970 ,,
III	Sulphate of Ammonia ...	,, ...	Spoilt	440 ,,
IV	Nitrate of Soda ...	,, ...	Spoilt	500 ,,
V	Basic Slag ...	,, ...	840 lbs.	1,800 ,,
VI	Superphosphate ...	,, ...	680 ,,	1,370 ,,
VII	Sulphate of Potash	,, ...	360 ,,	820 ,,
VIII	Superphosphate and Nitrate of Soda	,, ...	1,310 ,,	1,540 ,,

The sulphate of ammonia and nitrate of soda plots after maize looked little better than the unmanured plots, but as the greater part of both plots was damaged by a "wash-away," the results are not recorded.

Combining the results for the two years on the plots which bore two crops of maize the following figures are obtained:—

TABLE SHOWING PROFIT OR LOSS ON TWO YEARS' MAIZE CROPS THROUGH MANURING THE FIRST YEAR.

Plot	Manurial Treatment, 1908	Loss or Gain per Acre in 1908	Yield in 1909 per Acre	Increase in 1909 due to Manuring in 1907-08.	Value of Increase at 10s. per 200 lbs.	Total Gain or Loss due to Manuring in two years
		£ s. d.			£ s. d.	£ s. d.
I	No Manure	—	200 lbs.	—	—	—
II	Lime	loss 0 10 0	290 ,,	90 lbs.	0 4 6	loss 0 5 6
III	Sulphate of Ammonia ...	,, 1 3 8	—	—	—	,, unknown
IV	Nitrate of Soda	—	—	—	—	,, ,,
V	Basic Slag	,, 0 19 8	840 ,,	640 ,,	1 12 0	gain 0 12 4
VI	Superphosphate	,, 0 18 8	680 ,,	480 ,,	1 4 0	,, 0 5 4
VII	Sulphate of Potash ...	,, 0 2 7	360 ,,	160 ,,	0 8 0	,, 0 5 5
VIII	Superphosphate and Nitrate of Soda	gain 0 0 9	1,310 ,,	1,100 ,,	2 15 6	,, 2 16 3

Taking the two years' results into consideration there was thus a distinct loss through the use of each of the following dressings, viz., white lime, nitrate of soda, and sulphate of ammonia; a slight gain from the use of basic slag, superphosphate, and sulphate of potash; and a very considerable gain from the use of a mixture of superphosphate and nitrate of soda. Owing to a more favourable season the yields on all the plots except the last two were better than in the preceding year when the manures were applied.

The following interesting points are also brought out. From the appearance of the plots to which a nitrogenous manure like sulphate of ammonia or nitrate of soda alone had been applied no appreciable increase in yield was observable. The phosphatic manures (manures containing phosphate or phosphoric acid) on the other hand gave an even greater increase in the second year than they did in the first, and it is very probable that they are not yet exhausted. Further, it is evident by a comparison of Plots VI and VIII that on a poor soil a nitrogenous manure applied along with a phosphatic one caused a very considerable additional increase in crop, and that even such a soluble manure as nitrate of soda was partly available for the second year.

The general conclusion from this experiment is that this particular soil is too poor to grow maize profitably year after year without manure, and that a more or less complete fertilizer is required to give anything like a profitable return. Even with a complete fertilizer a profitable return can only be obtained by considering its effect on two seasons' crops. These results are exactly what might have been anticipated from the chemical analysis of the soil, which showed it to be very poor in all the elements composing the food material of plants.

Turning now to the plots which were manured in an exactly similar manner for cowpeas last year, and discounting the value of the small increases in yield of cowpea hay on the manured plots, we have the following result:—

TABLE SHOWING YIELD OF MAIZE AFTER COWPEAS WITH PROFIT OR LOSS THROUGH MANURING THE COWPEAS.

Plot	Manurial Treatment for Cowpeas, 1907-08	Yield of Maize 1909	Increase due to Manuring	Value of Increase at 10s. per 200 lbs. £ s. d.	Cost of Manure £ s. d.	Gain or Loss through Manuring	£ s. d.
I	No Manure	360 lbs	-		-		...
II	Lime	970 ,,	610 lbs.	1 10 6	0 14 0	gain	0 16 6
III	Sulphate of Ammonia	440 ,,	80 ,,	0 4 0	1 8 8	loss	1 4 8
IV	Nitrate of Soda ...	500 ,,	140 ,,	0 7 0	1 9 10	,,	1 2 10
V	Basic Slag	1,800 ,,	1,440 ,,	3 12 0	1 7 8	gain	2 4 4
VI	Superphosphate ...	1,370 ,,	1,010 ,,	2 10 6	1 10 8	,,	0 19 10
VII	Sulphate of Potash ...	820 ,,	460 ,,	1 3 0	1 3 10	loss	0 0 10
VIII	Superphosphate and Nitrate of Soda	1,540 ,,	1,180 ,,	2 19 0	3 0 6	,,	0 1 6

It will be observed that the only plots which show a distinct loss through manuring are those to which a nitrogenous manure (nitrate of soda or sulphate of ammonia) was applied, and nobody would think of using such manures for cowpeas, which have the power of using the nitrogen of the air and storing it in the soil for the use of the next crop.

The question arises as to whether it would not be more profitable to grow a leguminous crop every second or third year on such soil, than to grow maize continually even with manure. In the following table a comparison is given between the yields of two successive crops of maize, and of one crop of maize after cowpeas on the principal plots:—

Manurial Treatment in 1907-8.	Yield of Maize per Acre in 1908.	Yield of Maize per Acre in 1909.	Total for two years.	Yield of Maize after Cowpeas, 1909.	Increase or Decrease over two years' Maize.
No Manure	120 lbs.	200 lbs.	320 lbs.	360 lbs.	increase 40 lbs.
Lime	200 ,,	290 ,,	490 ,,	970 ,,	,, 480 ,,
Basic Slag	280 ,,	840 ,,	1,220 ,,	1,800 ,,	,, 580 ,,
Superphosphate	360 ,,	680 ,,	1,040 ,,	1,370 ,,	,, 330 ,,
Sulphate of Potash	545 ,,	360 ,,	905 ,,	820 ,,	decrease 85 ,,
Superphosphate and Nitrate of Soda	1,345 ,,	1,310 ,,	2,655 ,,	1,540 ,,	,, 1,115 ,,

These results are very instructive. On all except two plots there was a greater yield of maize in one year after cowpeas than in two years in both of which maize was grown. In the case of the plot manured with sulphate of potash the decrease is very small, and the result in the last plot is easily understood owing to the beneficial effect of the nitrate of soda in the first year. Where no nitrogenous manure was applied the result of the application of lime and of basic slag (which contains free lime) was very noticeable, probably largely on account of the lime encouraging "nitrification," i.e. rendering the nitrogenous root-residue left by the cowpeas available to the maize plants.

The insertion of a leguminous crop like cowpeas, velvet beans, or kaffir beans, into a rotation, has frequently been advocated in the *Journal*, and nowhere is this so necessary as on a poor sandy soil. A still greater increase in the yield of maize this year would probably have been obtained if the cowpeas had been ploughed under instead of reaped last year. The increased crop obtained on all the plots after cowpeas, in this experiment, was doubtless due to a variety of reasons, the chief of which are the following:—

(1) The cowpeas did not use such a large proportion of the manures applied last year as did the maize.

(2) There was a considerable addition made to the nitrogen in the soil by the root-residue of the leguminous crop, on which abundant nodules were found last year.

(3) Although witch-weed (rooi bloem) was present on the plots where cowpeas had been grown last year, its effects were evidently not so great as where maize had been grown.

GENERAL CONCLUSIONS.

1. In carrying out manurial experiments the residual value of the fertilizers used is a matter of greater importance in the Transvaal than in almost any other country.

2. Phosphatic fertilizers like superphosphate and basic slag may have a greater effect on the second crop than on that to which they are applied.

3. With our dry winter climate even such a soluble manure as nitrate of soda has some residual value.

4. It is possible that even on poor land the judicious use of fertilizers for mealies will give a profitable return when two years' results are taken into consideration.

5. On sandy soils the growth of a leguminous crop like cowpeas, velvet beans, or kaffir beans is very beneficial to the maize crop following.

6. If such soils are poor in lime it is a good plan to give a dressing of basic slag to the leguminous crop.

7. If a phosphatic fertilizer is used, a greater yield of maize may be obtained on sandy soils after a crop like cowpeas than would be got in two years where maize is grown continually.

II. THE DESTRUCTION OF "WITCHWEED" OR "ROOI-BLOEM" BY CHEMICAL MEANS.

By R. D. WATT, M.A., B.Sc., F.C.S., Acting Chief Chemist.

OF all the enemies to the successful growth of maize in the Transvaal perhaps none has such disastrous effects as the root-parasite *Striga lutea* (popularly known as "witchweed," or "rooi-bloem") whose pretty scarlet flowers are only too familiar on fields of growing maize. As a rule this parasite does not do much damage on new lands, though we have heard of cases in the Zoutpansberg where, even on newly-broken land, it has caused a serious reduction of crop. When maize has been grown for two or three years in succession on the same land its effect is so serious in many districts as to materially cripple, and in some cases to actually exterminate, the crop.

The popular belief is that the "witchweed" excretes a poison from its roots which kills the maize plants, but its action has been conclusively proved to be of a parasitic nature. That is to say, it attaches its roots to the roots of the maize from which it sucks the "life-blood."

The destruction of the plant by chemical means at first sight seems hopeless on account of the difficulty of killing the parasite without affecting the host-plant. After a careful study of the character of the plant it occurred to the writer that it might be destroyed in a somewhat similar way to that in which certain weeds like charlock are destroyed amongst growing oats in Europe, namely, by spraying with a solution of sulphate of copper.

The leaves of the witchweed are narrow, but their concave upper surface makes them well adapted for catching and retaining the solution. It was rather late in the season before any experiments were carried out this year and the parasite had already done all the damage it was capable of doing. A 3 per cent. solution of copper sulphate was used in an experiment at Koedoespoort, being simply administered by means of a watering can with a fine "rose." The success of this preliminary experiment was complete, as all the plants of witchweed were dead in two or three days, whilst the mealies apparently suffered no damage.

It is hoped to carry out a regular campaign against the scourge next year. In order that this may be done it will be necessary for the mealies to be sown in fairly straight rows at least three feet apart—the most satisfactory method of planting in any case.

It is probable that by using a proper spraying machine and a three per cent. solution of copper sulphate at the rate of about fifty gallons per English acre the desired result will be attained. The ordinary knapsack sprayer is rather clumsy to use, though it would have the advantage that it would be possible to spray only those portions of the lands which are affected by the parasite. Enquiries have been set on foot regarding the possibility of manufacturing a special spraying machine for the purpose (to be drawn by a horse or mule) on the same principle as the continuous action potato sprayer so much used in Europe. It would be necessary for farmers on badly affected lands to purchase such a machine for their own use. The expense would not be very great and the machine would be found very useful in the event of an insect plague such as the lucerne caterpillar or the army worm, and possibly also for the destruction of poisonous weeds on the veld.

The only other expense would be incurred in the purchase of copper sulphate or blue-stone which can be got for something like 4½d. per lb. Provided that a three per cent. solution at the rate of fifty gallons per acre was found sufficient, this would mean an expenditure of 5s. 7½d. per acre—a trifling cost if it should prove successful. Of course, it may be found that a two per cent., or even a one and a half per cent., solution may be quite as effective in our sunny climate. On the other hand, it may be found necessary to spray more than once as each successive crop of the parasite makes its appearance; but it must be remembered that other weeds would be destroyed as well. In any case the expense would not be too great to warrant farmers on land badly affected by the parasite expending the sum required to exterminate it.

The experiments which it is proposed to carry out next season will doubtless be watched with hopeful interest by those on whose farms this parasite is such a nuisance.

III. NOTES FROM THE CHEMICAL LABORATORIES.

By R. D. Watt, M.A., B.Sc., F.C.S., Acting Chief Chemist.

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(1) Feeding Stuffs.

(*a*) *Maize Bran and "Seconds."*—A number of mining companies are now supplying their "boys" with sifted maize or mealie meal, with the result that two by-products are now being placed on the market, namely maize bran and "seconds."

Two samples of the former and one of the latter were recently analysed in our laboratories, with the following result :—

	Maize Bran No. I.	Maize Bran No. II.	Seconds.
Moisture	13.8	11.6	11.9
Ash	1.9	2.0	1.6
Protein	7.7	7.8	10.2
Carbohydrates	56.3	57.8	62.8
Fat	5.5	5.7	6.3
Fibre	14.8	15.1	7.2
	100.0	100.0	100.0

For purposes of comparison, I quote the average of seventy-seven American analyses of maize meal and five analyses of maize bran :—

	American Maize Meal.	American Maize Bran
Moisture	15.0	9.1
Ash	1.4	1.3
Protein	9.2	9.0
Carbohydrates ..	68.7	62.1
Fat	3.8	5.8
Fibre	1.9	12.7
	100.0	100.0

An explanation of the meaning of these terms will be found in the January (1909) number of the *Agricultural Journal.*

From the above analyses it would appear that the bran contains much more fibre (mainly indigestible) than maize meal, but is slightly richer in oil, though poorer in protein and in carbohydrates (starchy matter). In spite of that the bran is not to be despised, and for feeding pigs especially it is well worth 2s. 6d. to 3s. per 100 lbs.

The " seconds " again contain more fibre and less starchy matter than the maize meal, but the percentage of protein is slightly higher, so that in feeding value for cattle and pigs they do not fall far short of maize meal.

It must be distinctly understood that maize bran can never be a proper substitute for wheat bran, which contains about double the percentage of protein, and, if the bran is fed to dairy cows in full milk, it must be supplemented by some feeding stuff rich in protein.

(*b*) *Pea-nut Cake.*—Reference has frequently been made in the *Journal* to this product which consists of the residue left after the extraction of the oil from the kernels of the pea-nut, ground-nut, earth-nut, or monkey-nut. A good deal of oil is left in the pressed cake, but it is chiefly valuable on account of the large percentage of protein it contains. It, therefore, forms a very useful addition to the ordinary diet of farm animals which is apt to be deficient in this valuable ingredient. For the sake of this by-product alone, it is to be hoped that the growth of pea-nuts will greatly extend in this Colony.

A sample of this feeding stuff which was quoted at £6 10s. per ton at Delagoa Bay, was recently analysed here and found to contain 46.5 per cent. of protein and 8.3 per cent. of oil.

(*c*) *Linseed.*—A number of enquiries have recently been received about the composition of linseed or flax seeds and of the cake left after the extraction of the linseed oil. There can be no doubt about the fact that if this plant could be grown successfully in the Transvaal (and there are indications that it can), a great boon would be conferred on dairy farmers and those interested in the rapid fattening of stock. The seeds themselves usually contain about 22 per cent. of protein and 33 per cent. of oil or fat. The objection to the use of the seeds, either whole or ground, is that the large percentage of oil causes them to have too laxative a tendency. Ground linseed, however, fed in small quantities along with skimmed milk or buttermilk and boiled maize meal is an excellent food for calves, after they have ceased to get whole milk.

An imported sample of linseed cake from which a large percentage of the oil had been extracted by pressure contained 32.5 per cent. of protein and 7.9 per cent of fat or oil. This represents a feeding stuff of the very highest quality, and like pea-nut cake, it is very useful for increasing the percentage of protein in the diet of farm stock.

(2) Cream.

As a result of the establishment of creameries in various parts of the colony a large number of farmers are sending cream by rail, and being paid according to the percentage of butter-fat in the cream. Some of them are evidently suspicious regarding the variations in the quality of the cream from day to day and week to week as judged by the analyses made at the creameries. We have, therefore, received a number of samples for analysis, and have sent reports so as to satisfy the senders as to the reliability or otherwise of the creamery tests. We are very pleased at all times to perform such analyses free of charge for farmers for their own information. If, however, they wish to take proceedings against a creamery company, it will be necessary for them to employ a private analyst. In sending samples it is of the utmost importance to observe the following directions :—*Samples should completely fill the bottles, which need not be larger than half a pint. They should be despatched as promptly as possible, and advice of their despatch sent by the same post to this Division.*

Through neglect of these precautions some recent samples have arrived in such a state that it was almost, if not quite, impossible to obtain a uniform sample for analysis.

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(3) Starch.

An excellent sample of home-made starch was recently received from Mrs. Hesselman, of Zandspruit. The process of manufacture was not stated but it had evidently been extracted from maize.

In the United States of America, the manufacture of starch from maize is quite an important industry, the essential steps in the process being as follows :—

The maize, after all the impurities have been thoroughly removed, is steeped in water for eight or ten days, until putrefaction has set in, and the grain is soft enough to grind. By this process a good deal of the protein and "ash" is removed. After grinding, the meal is mixed up with water and passed through sieves of brass wire and finally through bolting silk. The starch passes through with the water, and the residue is used for feeding cattle and pigs. The milky fluid containing the starch

is allowed to settle and the water poured off. Fresh water is added, and then a solution of caustic soda is run in gradually, until a greenish yellow colour is produced, after which the mixture is stirred for some hours. It is again allowed to settle and washed; more water is poured in, and the top liquid containing the starch syphoned off. The starchy liquid is again passed through silk strainers, the starch allowed to settle, and the water poured off. The moist starch is then placed in moulds with perforated bottoms and allowed to drain, after which the starch is taken out, cut into blocks and subjected to a gradually increasing temperature until all the water is removed and practically pure starch remains in the form of the well-known prisms.

(4) Manures made from Local Products.

(*a*) *Bone Dust.*—Attention has frequently been called to the suitability of finely ground bones for most crops on Transvaal soils. After the removal of the oil bones grind to a fine powder which contains about 50 per cent. of phosphate of lime and 3¾ per cent. of nitrogen. Even if in a fine state of division their action is rather slow, and, as they continue to give a return over a series of years, they can hardly be surpassed for building up the fertility of soils. It is, I think, no credit to the enterprise of the farmers of this Colony that bones are at present being sent from Johannesburg to Durban to be ground and used as a fertilizer by the Natal farmers.

Several local firms are now turning their attention to the manufacture of bone dust. The special bone dust of a well-known Transvaal firm is in a very fine state of division, and therefore capable of thorough incorporation with the soil. At the price demanded, £6 5s. per ton, this manure is quite a good investment for farmers, on sandy soils especially.

Another company also produces a sample of bone meal at £5 per ton, which is also quite good value for the money, although the oil has not all been removed. I should like again to emphasise the fact that the oil in bones has no manurial value, but is a positive drawback, as it adds to the weight of the bones and prevents thorough grinding, and also retards the decomposition of the bones in the soil.

(*b*) *Shoddy Dust.*—Shoddy or wool waste is used to a considerable extent in Europe as a manure, especially for hop and vegetable gardens. It is valuable chiefly for its nitrogen, though it usually contains a little potash as well. The chief drawback to its use is that it acts rather slowly, though recent experiments at Rothamsted (England) have shown that its action is quicker than was previously supposed. In this country it would probably decompose and become "available" to plants much more quickly than in Europe. A sample of such shoddy dust which is produced in small quantity as a by-product from a factory at Turffontein was recently submitted for analysis and found to contain 3.7 per cent. of nitrogen and 0.4 per cent. of potash. Compared with the prices of artificial manures at the coast, its value would be about £3 per ton of 2,000 lbs. The nitrogen which it contains, however, is only considered to have half the value of the same amount of nitrogen in concentrated artificial fertilizers, so that its real value is £1 10s. per ton.

It should be specially useful on sandy soils for fruit trees and vegetables of all kinds, and might be applied in any quantity up to half a ton per acre. To give its best return it ought to be accompanied by

some manure containing phosphoric acid like superphosphate or basic slag. Owing to its bulky and absorbent nature, it would improve the water retaining powers of any soil to which it was applied. Though not worth transporting to any great distance, it should be quite useful for market gardeners in the neighbourhood of Johannesburg.

(5) A Rich "Vlei" Soil.

We have recently had occasion to analyse a sample of soil from J. H. Scholtz, Esq., of Appledoorn, Carolina, which proved to be so much richer in plant food than the average run of Transvaal soils that the result is worth recording. The figures represent the amounts of the various ingredients in the "air-dry" soil.

	Appledoorn Soil. Per cent.	Average Transvaal Soil. Per cent.
Moisture	13.44	2.40
Loss on ignition (organic matter, etc.)	14.96	5.84
Insoluble matter (sand, etc.) ..	56.87	79.88
Oxide of iron and alumina . ..	13.42	11.09
Lime	0.44	0.24
Magnesia	0.33	0.15
Potash	0.33	0.19
Phosphoric acid	0.15	0.055
	99.91	99.845
Containing nitrogen	0.504	0.114
"Available" potash	0.0010	0.0113
"Available" phosphoric acid ..	0.0177	0.0069

It will at once be seen that the Appledoorn soil is much richer than the average in all the important elements of plant food—nitrogen, lime, potash, and phosphoric acid. The only disappointing thing is the low availability of the potash present. This can probably be easily remedied by cultivation as the total amount of potash in the soil is very satisfactory. The soil is really a recently drained "vlei" which shows evidence of a fertility which one would expect from its chemical analysis. The large percentage of nitrogen has the tendency to produce leaf and stem rather than seed or tubers, and Mr. Scholtz informs me that potatoes growing in this soil were from four to five feet in height. The crop of potatoes, though satisfactory, was not so great as one would have expected from the appearance of the crop above ground, which is doubtless accounted for by the small percentage of available potash present; so that even on this rich soil it might pay to use a manure containing potash for potatoes in the first year or two after the land is broken up.

As our vlei soils are as a rule much the richest in the country, the question of whether it would not pay to drain many of them is worth the serious attention of farmers.

Correction.—In an article in the last issue of the *Agricultural Journal* (No. 27) dealing with the effect of manures on potatoes, the variety of potato was wrongly stated to be German Blue. The variety actually used in the experiment was "Sutton's Flourball."

The Botanical Section.

I. "BLACK SCAB," OR "WARTY DISEASE," OF THE POTATO.

By I. B. Pole Evans, B.A., B.Sc., F.L.S., Plant Pathologist.

The object of the present note is to afford potato growers in this Colony some information regarding a disease of the potato prevalent in the British Isles and Germany, so that they may be on their guard against it should it appear either in imported "seed" or in the crops raised from the same.

The disease is commonly known as "Black Scab" or "Warty Disease." Its general appearance is shown in Plates 91, 92, and 93. Warty disease was first noted in Upper Hungary in 1896, and very shortly afterwards it appeared in England, and it has now spread to Wales, Scotland, and Ireland. The disease is caused by a minute fungous parasite named botanically *Chrysophlyctis endobiotica*, Schilb.

All growing parts of the potato plant may be attacked by the fungus, but it is usually the tubers that are rendered most conspicuous as a result of the disease. They become covered over with wrinkled and warty excrescences, which may almost be as large or even larger than the tuber itself.

When the shoots above ground are affected, they not infrequently develop clusters of minute leafy outgrowths densely crowded together. Oftentimes there may be very little evidence of the disease beyond a slight discoloration or blackening of the "eyes" of the tubers (Plate 92), and as such tubers contain the germs of the fungus they are perhaps a greater source of danger to the farmer than more conspicuously affected "seed," since they are less liable to detection, and consequently more likely to be used for planting purposes. When the diseased potato rots, the surrounding soil becomes contaminated with the germs of the fungus, and it has been definitely proved that these germs in the ground, even after a two years' rest, are capable of infecting a crop in the third year. There is also some evidence to show that the germs may remain dormant in the soil for as long a period as six years, and then renew the disease.

Some varieties of potatoes are said to be more liable to the warty disease than others. British, Eldorado, Factor, Herd Laddie, Princess May, Kidney, Scottish Triumph, Up-to-date are stated to have suffered more or less severely, whereas Bashford Beauty, Clarke's Seedling, Lillie Langtry, Lord Tennyson, and Purple Perfection are reported to have exhibited decided immunity to the trouble.

Up to the present this pest has not been detected in South Africa, and it is against its introduction into this country that the farming population should be specially on the alert, and immediately forward any tubers suspected of the disease to their respective Agricultural Departments for examination and report.

Owing to the prevalence and recent spread of warty disease in the British Isles and Germany, and with a view to preventing its introduction into this Colony along with imported "seed," the Transvaal

Department of Agriculture, under Government Notice No. 646 of 1909, requires every consignment of potatoes from oversea for this Colony to be accompanied by a certificate from the consignor stating fully in what country and district the potatoes were grown, and also a certificate from the Board of Agriculture of the country in which the potatoes were grown to the effect that the disease has not been declared to exist in the district from which the potatoes came. Any consignments not accompanied by such certificate are liable to be seized and destroyed by the Department of Agriculture.

II. THE JUDGING OF SEED MAIZE.

By Joseph Burtt-Davy, F.L.S., Government Botanist.

Farmers who are anxious to improve their maize crop wish to know the desirable characters to select when choosing their seed-ears, and as we have received many inquiries on the subject it seems desirable to publish information upon it.

The aim of maize judging is to determine the best sample for seed purposes by comparing with a uniform standard. By best seed maize is meant that which will yield the most grain of the best quality either for feeding or for market, and which is therefore the most profitable to grow. The method adopted is to carefully compare the samples with a standard scale of points, which standard is recognised as embodying all of the qualifications of the best seed maize. These qualifications include:—

1. Such points as insure good yield, as size, uniformity and shape of ears, well-filled butts and tips, shape of grain, yield of grain per ear, percentage of grain to cob, etc.
2. Such as insure a perfect stand, as per cent. and vigour of germination.
3. Such as insure high quality for consumption or export, as maturity, soundness, dryness, etc.
4. Trueness to type and breed, characteristics in shape, colour, etc.
5. The value of the sample for feeding or manufacturing purposes, such as the comparative percentage of protein, oil, starch, etc.

These standards have been developed and arranged by experienced growers, breeders, and judges to such a degree that a sample which comes up to them has been found to be the best yielding, has the best degree of vitality, and is the most profitable seed to grow, and consequently commands the highest price as seed. Maize breeding has developed with such rapid strides during the last ten years, and so many new breeds and strains have been developed and are constantly appearing on the market—and the same breed is often sold under so many different names—that standards of perfection have not yet been established for all of them. Many of these sorts are doomed to drop out in the struggle for the survival of the fittest.

Owing to the fact that the maize plant is affected by climatic conditions, so that samples of a breed grown in one State or Province may differ from those produced in another, it has been found necessary to adopt different standards for the same breed in different parts of the country. Under such differences of climatic conditions as between

the United States and South Africa, it may be found necessary to modify the American standard to meet local conditions; e.g. 10 inches is the standard length in Illinois for an ear of Riley Favourite maize. Perhaps it may not be found practicable with that breed to grow ears of the same size in South Africa. On the other hand 7½ to 8½ inches is the usual length for ears of eight-row Hickory King in the States. We have found it possible to grow ears of this breed 11½ inches long (in a particularly favourable season), and it may prove desirable to set a higher standard than 8½ inches for South Africa. These points can only be determined in the course of time and by taking an extended series of measurements in different localities, and under varied conditions. In the meantime it is best to take the American standards as a guide.

In the different States it has also been found necessary to adopt different score cards, and no one of these seems entirely suited to the peculiar conditions of South Africa, so that we in the Transvaal have found it desirable to make up our own score card, taking the good points from each of the American cards.

In spite of these slight differences, the general principles of maize judging apply to all conditions and in all states and countries alike, and must be thoroughly understood in order to judge maize successfully. At the judging table it is absolutely necessary for the judge to keep in mind that he has not only to compare one sample with another, but each sample with the standard, separately and independently, in order to determine its individual merits. It is a good plan to use a printed score card of uniform size and shape, on which the scores of the different exhibits in any one class may be entered; these should be laid out side by side, so that at any time a comparison of scores may be easily and quickly made. Where there are many entries and the scoring is at all close, it is desirable to refer from time to time to the score previously given for the same point in the other exhibits; unless this is done it is difficult for the judge to carry in mind the exact cut made for that point in previous cases. It must also be borne in mind that though the score card is a most useful adjunct and guide in the hands of a competent judge, it must not be used in an absolutely mathematical sense, otherwise certain points which cannot be mathematically recorded on the score card will be neglected and a wrong decision will result. In other words, there are no absolute rules which can be laid down by which maize samples can be properly judged, independent of that intuitive perception of good and bad points which accompanies experience in a born judge.

The judgment of the person who is comparing the sample must enter into the score, and his experience guide him in marking each point on the score card. There are some men who are born judges, and who can intuitively judge by eye without the aid of the score card; and there are a few who claim to find the score card a hindrance, because their perception and summarizing of points go together so quickly; but we believe such men are rare. To the average judge of maize the score card is of great assistance if used properly. There are so many points in a good sample, that one is apt to place too high a value on those which can be taken in at a glance, such as length of ear, uniformity, narrow sulci, good colour,

and good tips, to the neglect of such important points as shape and depth of grain, circumference, yield per ear, percentage to cob, shape of ear, and the like.

In exhibits of maize ten ears is a desirable number for an exhibit. This number makes it possible to get a fair idea of general uniformity and trueness to type and breed characteristics, and affords an easy number for calculating the percentage of points. In offering prizes at shows, I have sometimes called for entries of 25 ears in order to get a better idea of the crop from which the sample was taken. From these 25 I have selected out the 10 best ears, and have based my award on these ten; the farmer has thus had the benefit of my experience while I have had a better idea of his crop. Other things being equal, a large number of ears is better than a small number, as it is more difficult to get a large number if the crop is poor; on the other hand, an exhibitor should not be allowed to show more ears in an exhibit than are called for by the prize list, for he may in this way avoid the responsibility, and lose the educational value, of deciding for himself which are the best ears to exhibit.

In addition to calling for exhibits of ten ears, prizes are frequently offered for exhibits of the best individual ear of a certain type or breed. This has an important educational value if the entries are numerous and the judging sufficiently strict. But inasmuch as it is so much easier to pick one good ear than a uniform sample of ten good ones, the one best ear competition is less desirable in districts or at dates where or when the competition is not keen.

Where 25 or 100 ears, more or less, are called for, the judge should take out 10 ears—say every tenth in the hundred—and judge this sample for all of the points, except uniformity of exhibit and such other general characteristics as may require the whole sample.

In selecting ears for and despatching them to a show great care should be taken that the individual ears are not injured in any way. This requires particular care in our dry climate. By carelessly dropping an ear on the table or floor part of the kernels may be knocked off or injured. This will make it impossible to determine accurately the yield per ear, or the percentage of grain to cob. It will also leave the judge in doubt as to whether those grains were removed accidentally, or on purpose to disguise cross-pollination. In such cases it is usual, therefore, for the judge to score as for discoloured or cross-bred grains, i.e. one-tenth point for every missing grain in each ear. During the process of judging, therefore, the ears should be handled as little as possible consistent with a careful examination of all points.

The ears should always be laid down in the same order as taken up, and in such manner that they will not be injured in any way. In no case is it necessary to twist or break the ears, in this way injuring them for future examination. These points are matters of training and experience.

In judging maize, it is necessary to expedite matters as much as possible. All unnecessary moves must be left out. The eye must be trained to accurately judge any one point at first examination. Ten minutes is usually considered long enough to judge all points in a sample except the shelling and weighing of representative ears to

determine the weight and percentage of grain on the ear, and this should be undertaken by a competent assistant while the next sample is being dealt with.

THE PRIZE LIST.

A proper classification in the prize list of an agricultural show is one of the most important means of developing the maize industry. The custom of allowing one recognised breed to compete with another in the same class (except for a championship) must be discontinued as soon as possible. Until we are more certain as to which are the best breeds to grow in the country, and can confine ourselves to giving prizes for them, it will be practically impossible, and certainly undesirable, to draw too hard and fast a rule in this respect. We have, however, got well beyond the stage of giving a prize for "the best bag of white mealies," which we can remember having been the sole requirement at some of our shows only a year or two ago. But there is much improvement to be effected yet, even at our best shows, before we can reach even a fair state of development.

The following is a sketch of a desirable prize list:

Section A.

Prizes for best exhibits of ten ears of standard breeds of white maize. First prize, £1 1s.; second, 10s.; third, 5s.; in each class.

Class 1. Hickory King (eight row).
,, 2. Louisiana Hickory (ten row).
,, 3. Iowa Silver Mine or Champion White Pearl.
,, 4. Ladysmith, North American, or Virginia Horsetooth.
,, 5. Natal White Horsetooth or Hickory Horsetooth.
,, 6. Any white Flint breed.
,, 7. Other white breeds.

Section B.

Prizes for best exhibits of ten ears of standard breeds of yellow maize. First prize, £1; second, 10s.; third, 5s.; in each class.

Class 8. Chester County Mammoth or Bristol 100-day.
,, 9. Eureka or King of the Earliest.
,, 10. Yellow Hogan or Star Leaming.
,, 11. Austin's Colossal or Yellow Horsetooth.
,, 12. Golden King.
,, 13. Any yellow Flint breed.
,, 14. Other yellow breeds.

Section C.

Prizes for best muid of shelled maize. First prize, £5; second, £3; third, £2; in each class.

Class 15. White Dent.
,, 16. White Flint.
,, 17. Yellow Dent.
,, 18. Yellow Flint.
,, 19. Mixed (Dent or Flint, yellow or white).

Section D.

Prizes for best single ears of maize. First prize, 5s.; second, 2s. 6d.; third, 1s.; in each class.

Class 20. Hickory King (eight row).
,, 21. Louisiana Hickory (ten row).
,, 22. Iowa Silver Mine or Champion White Pearl.
,, 23. Ladysmith, North American, or Virginia Horsetooth.
,, 24. Natal White Horsetooth or Hickory Horsetooth.
,, 25. Any white Flint maize.
,, 26. Other white breeds.
,, 27. Chester County Mammoth or Bristol 100-day.
,, 28. Eureka or King of the Earliest.
,, 29. Yellow Hogan or Star Leaming.
,, 30. Austin's Colossal or Yellow Horsetooth.
,, 31. Golden King.
,, 32. Any yellow Flint breed.
,, 33. Other yellow breeds.

Section E.

Prizes for best exhibit of ten ears of breeds of Sweet Maize.

Section F.

Prizes for best exhibit of ten ears of breeds of Pop Maize.

Suggested Rules governing Exhibits.

1. No exhibit can be entered in more than one class.

2. Only one entry can be made by an exhibitor in any class.

3. An exhibitor is barred from exhibiting in more than ten classes (in time this may be reduced to five, and eventually to three if desirable).

4. The samples must have been grown by the exhibitor during the summer immediately preceding the exhibition.

5. The samples must not be treated unfairly by taking out poor, cross-bred, or otherwise undesirable kernels and replacing them by good ones. Any unfair or tricky occurrences bar the exhibitor from all entries and all privileges of the exhibition.

But grooming of the ears in such a manner as to allow of the best possible natural presentation is strongly recommended.

The above outline for a prize list is intended to be suggestive only; it would require cutting down to meet the needs and conditions of the smaller district shows by cutting out all breeds not grown in the particular district.

Score Card for the Transvaal.

The following score card is being used by me; it is adapted from the various score cards of the leading American maize-growing States:—

TRANSVAAL SCORE CARD FOR MAIZE.

Show.................................... Date....................................

No. of Exhibit........................ Breed ....

STANDARD OF PERFECTION.

Ear: length .... inches: circumference ...... inches: yield of grain per ear ......

Kernel: width ...... mm.: length ...... mm.: shape ....: dent ....

SCORE.

	Points. Possible.	Awarded.
1. Uniformity of exhibit (indicating careful selection for several generations) ...	5	
2. Trueness to type or breed characteristics ...	5	
3. Shape of ears and straightness of rows. (A cylindrical ear is more likely to be accompanied by uniformity in size and shape of grain than a tapering ear) ...	10	
4. Colour of grain (cut for variation in shade or tint) ...	5	
5. Colour of cob. (A white breed should have a white cob, and a yellow breed a red cob,* cut one point for each ear not true to type in this respect. No ear that carries mixed grains should be used for seed.)	5	
6. Market condition (i.e. soundness of ear and kernels, and firmness of kernels on cob). Kernels should be free from decay, and should be well filled, not shrivelled, nor chaffy ...	5	
7. Tips should be regularly covered with uniform kernels so that no part of the cob end can be seen ...	5	
8. Butts should not be swollen and irregularly covered; rows of kernels should extend evenly beyond end of cob round the shank ...	5	
9. Kernel uniformity (in length, shape, and thickness) ...	5	
10. Kernel, shape, and length. (The longer the kernel, if in good proportion to width, the greater the yield of grain) ...	10	
11. Length of ears ...	10	
12. Circumference of ears (this should be approximately as 7½ to 10 inches, or 8 to 12 inches) ...	5	
13. Space between rows. (A wide space between rows means waste of space that should be filled with grains)...	5	
14. Space between kernels at the cob ...	5	
15. Percentage of grain to cob ...	5	
16. Weight of grain per ear ...	10	
TOTAL ...	100	

NOTES:

* Most yellow flints have white cobs, as also is the case with Golden King and Natal Yellow Horsetooth, and these should not be cut on that account.

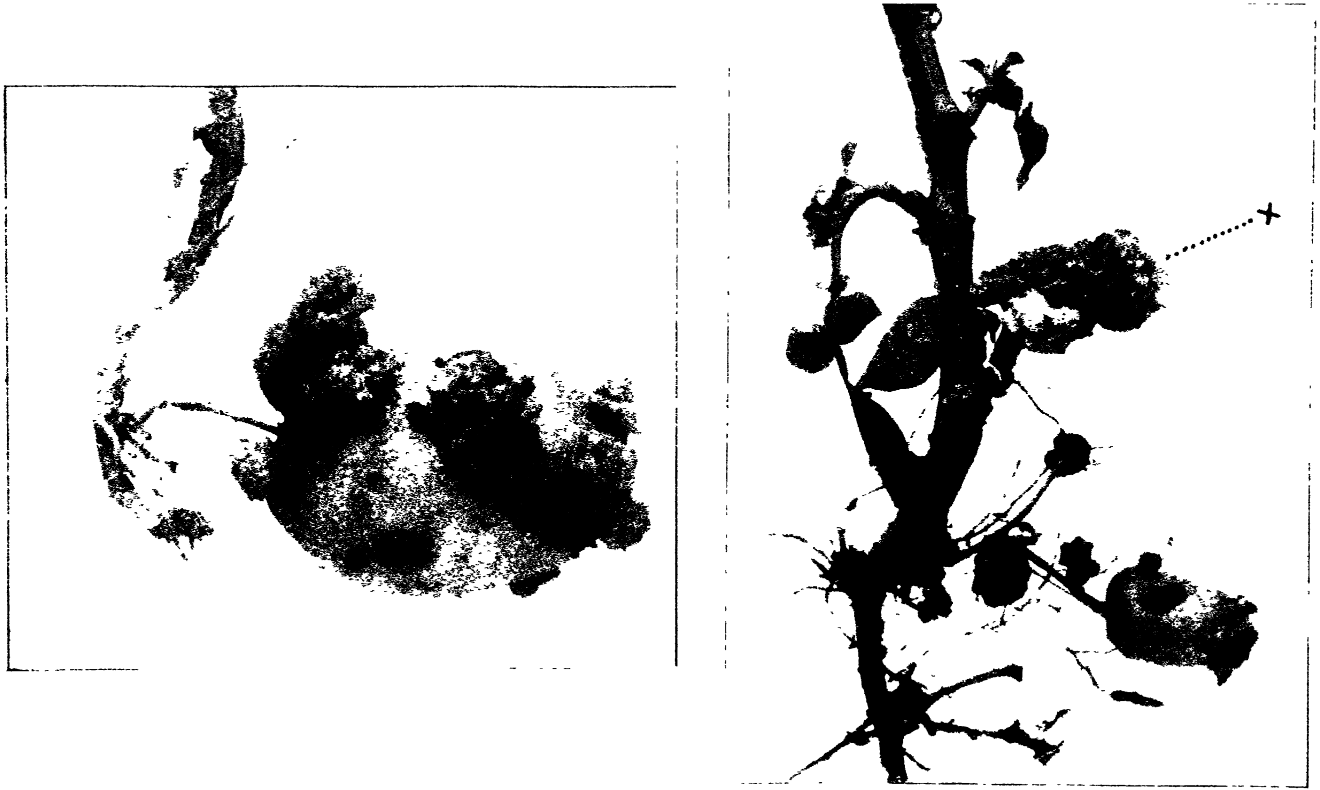
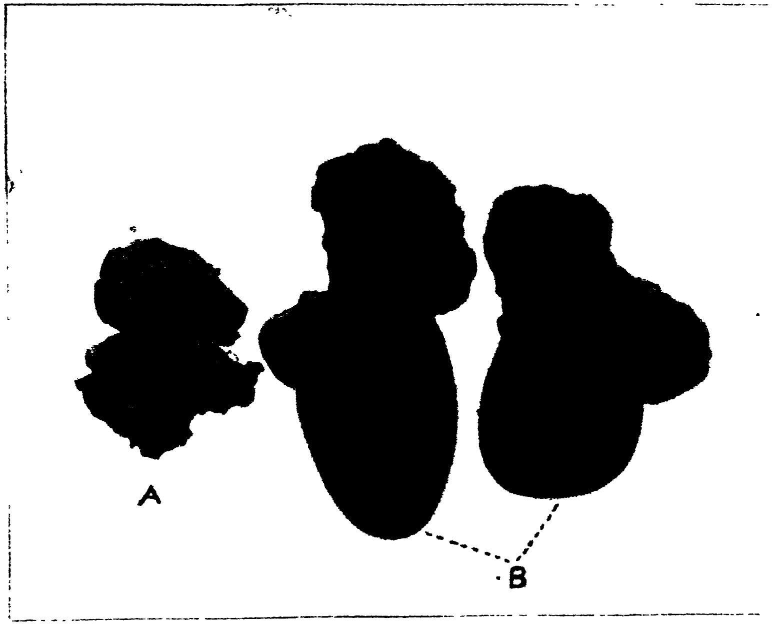


Plate 51.

Black Scab or Warty Disease of the Potato.

(*Chrysophlyctis endobiotica* Schilb.)

(After Hammond in Report of South-Eastern Agricultural College, Wye.)



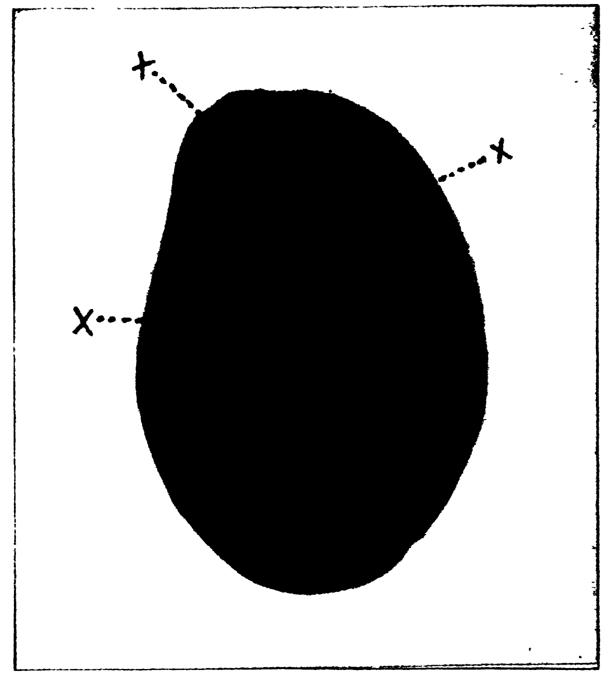


Plate 92.

Black Scab or Warty Disease of the Potato.

(*Chrysophlyctis endobiotica* Schilb.)

(After Hammond in Report of South-Eastern Agricultural College, Wye.)

Plate 93.

Black Scab or Warty Disease of the Potato.

(*Chrysophlyctis endobiotica* Schilb.)

(After Hammond in Report of South-Eastern Agricultural College, Wye.)

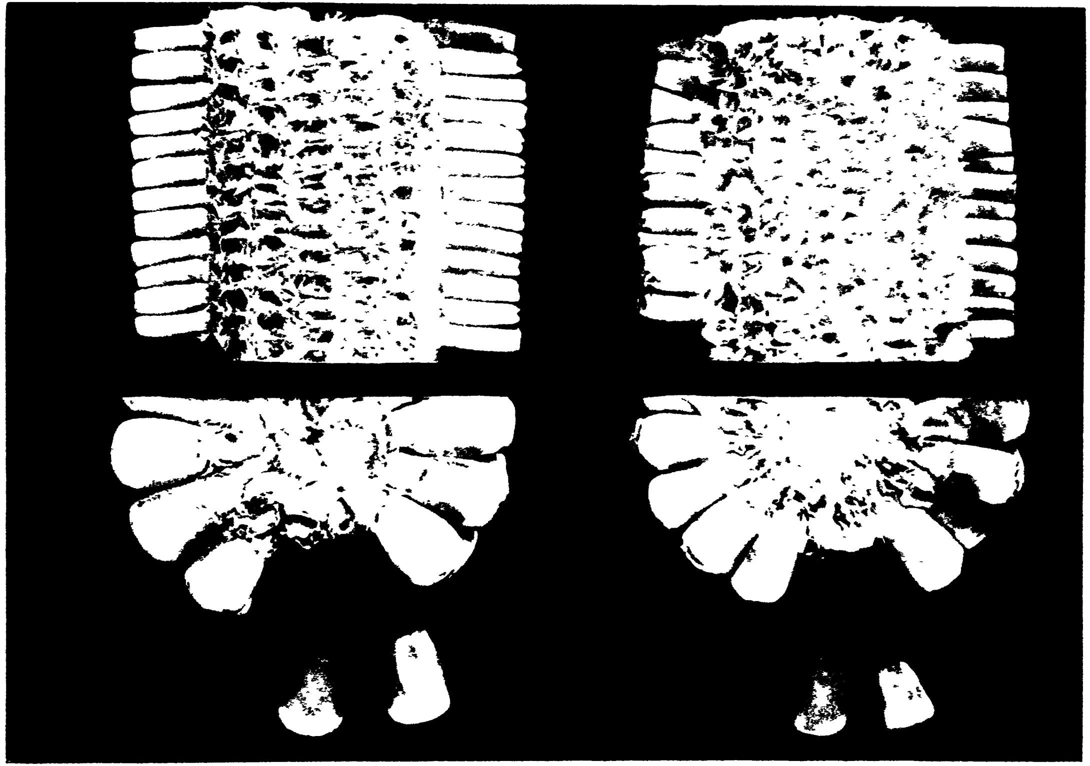


Plate 94. Fig. 1. Fig. 2.

Variation in Depth of Grain in two ears of the same breed of Maize.

Fig. 1 shows a well-bred ear, with deep and uniform kernels. Fig. 2 shows a poorly-bred ear, with shallow irregular kernels.
(U. S. Department of Agriculture Year Book.)

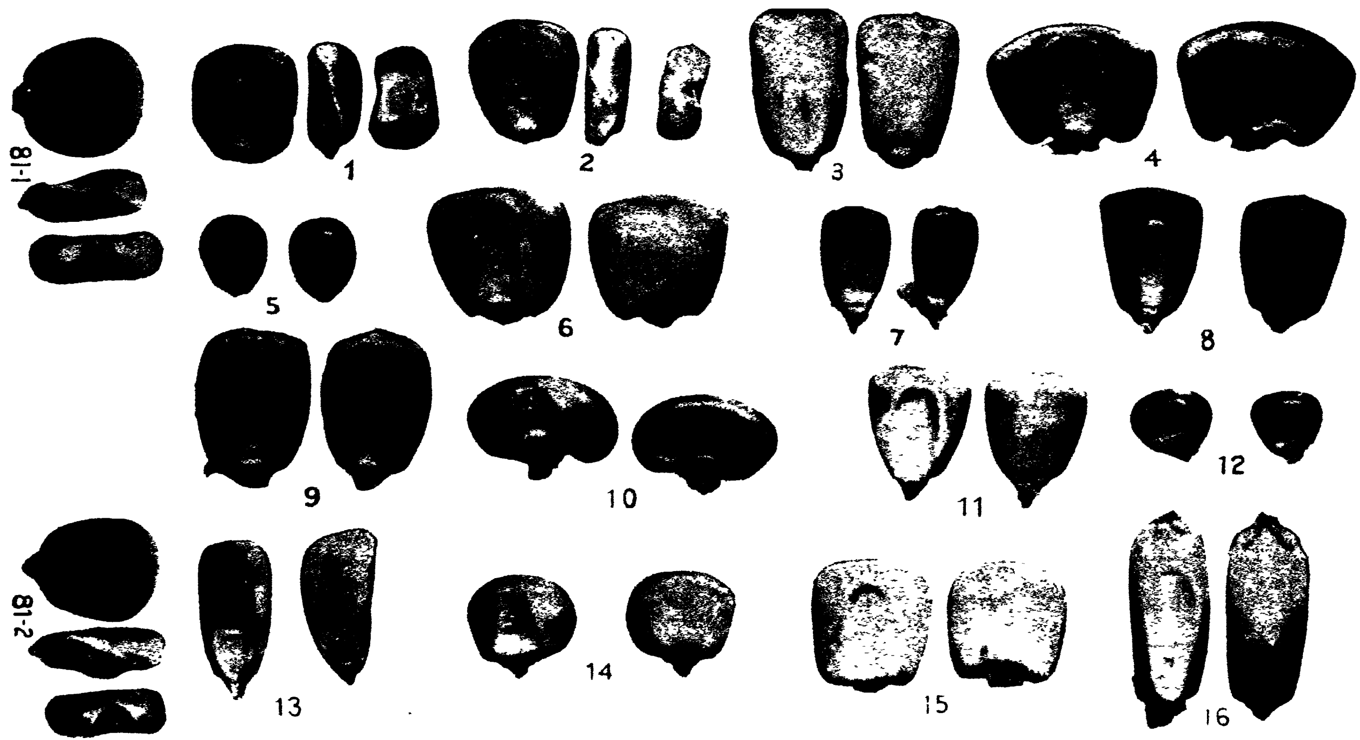


Plate 95. **Variation in Types of Maize.**

Of the above kernels the left one of pair 8 is the most nearly perfect. It is sufficiently wide at the base to give space for a large germ, which means good germination and a healthy young plant, and at the same time the width at the top permits of no space between rows. The other member of this pair is inclined to bulge over-much at the middle although very good. The extreme rounding at the middle is particularly noticeable in No. 9. No. 11 has a weak germ and much lost space between rows near the cob. Nos. 6, 4, and 15 are so broad at the base that much space is lost between rows at the top. No. 3 is a very good kernel and is particularly deep, but to be perfect should be wider at the top. No. 16 is remarkable for depth, but is of the shoe-peg rather than the wedge type, and the spaces between rows would be very great. To secure the depth of No. 16 with the shape of No. 8 is the aim of every breeder. The defects of Nos. 5, 7, 10, 12, 13, and 14 are evident. (After U.S. Department of Agriculture Year Book.)

Plate 96

Branch of Kaffir Gift-boom.

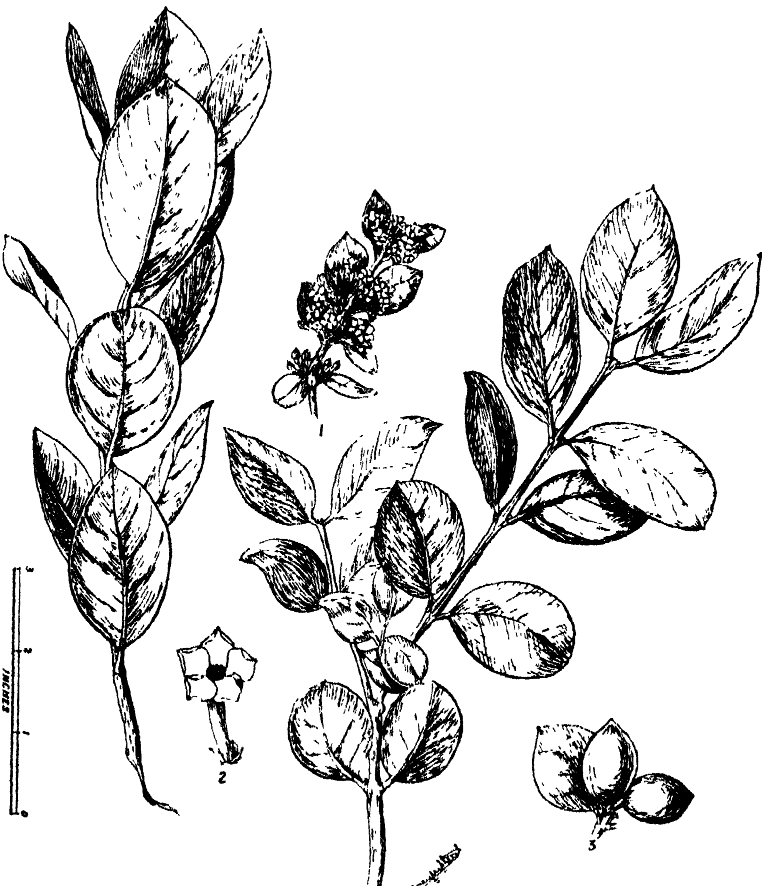


Plate 97.

The Kaffir Gift-boom.

(*Acokanthera venenata* G. Don ; family *Apocynaceae*.)

1. Flowering branch. 2 Single flower (enlarged). 3. Fruit.

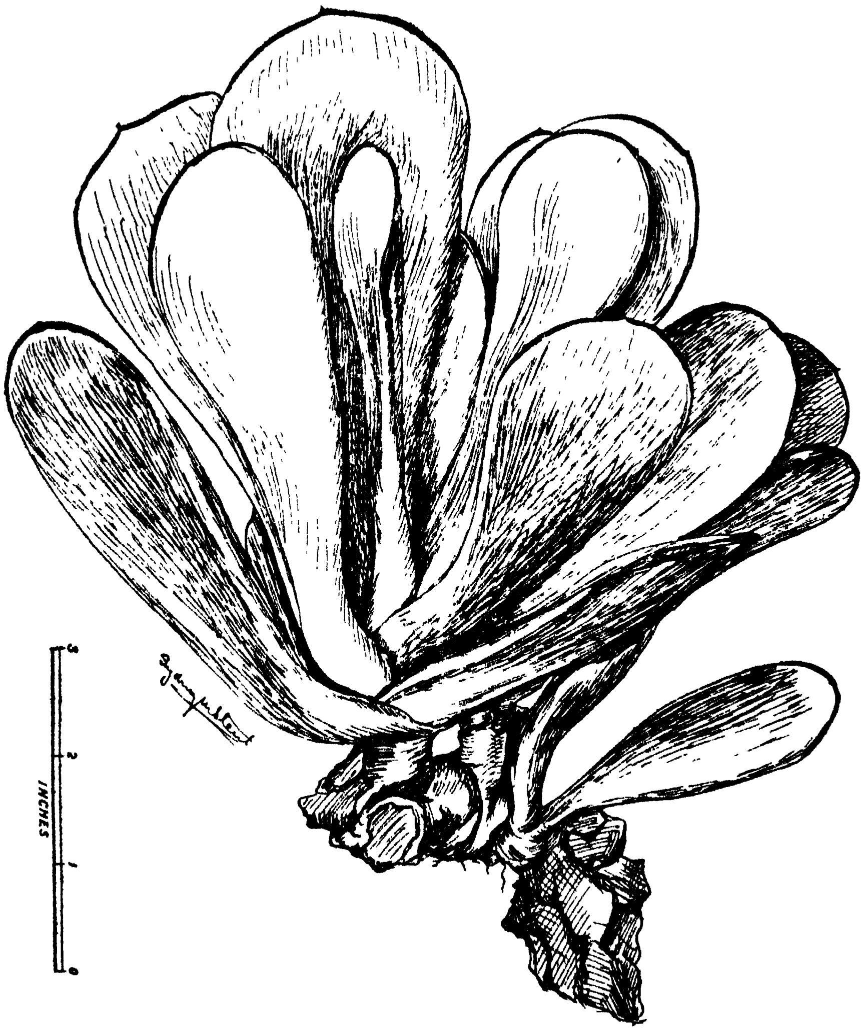


Plate 98.

The Varkens-ooren.

(*Cotyledon orbiculata* L., family *Crassulaceæ*.)

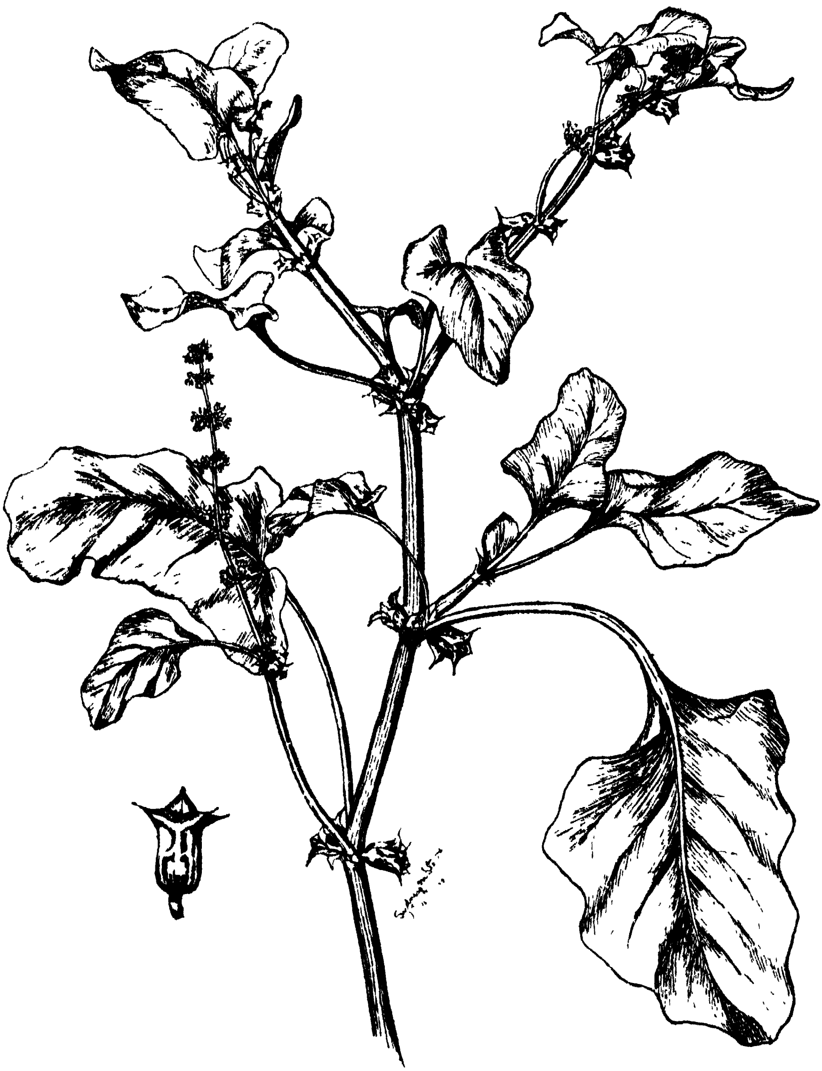


Plate 99.

The Devil's Thorn or Dubbletje-doorn.

(*Emex centropodium* Meissn. : family *Polygonaceæ*.)

Plate 100.

The Plantain-herb.

(*Plantago major* L.: family *plantaginaceæ*.)

Occasionally found as a weed in gardens and along town water-furrows.

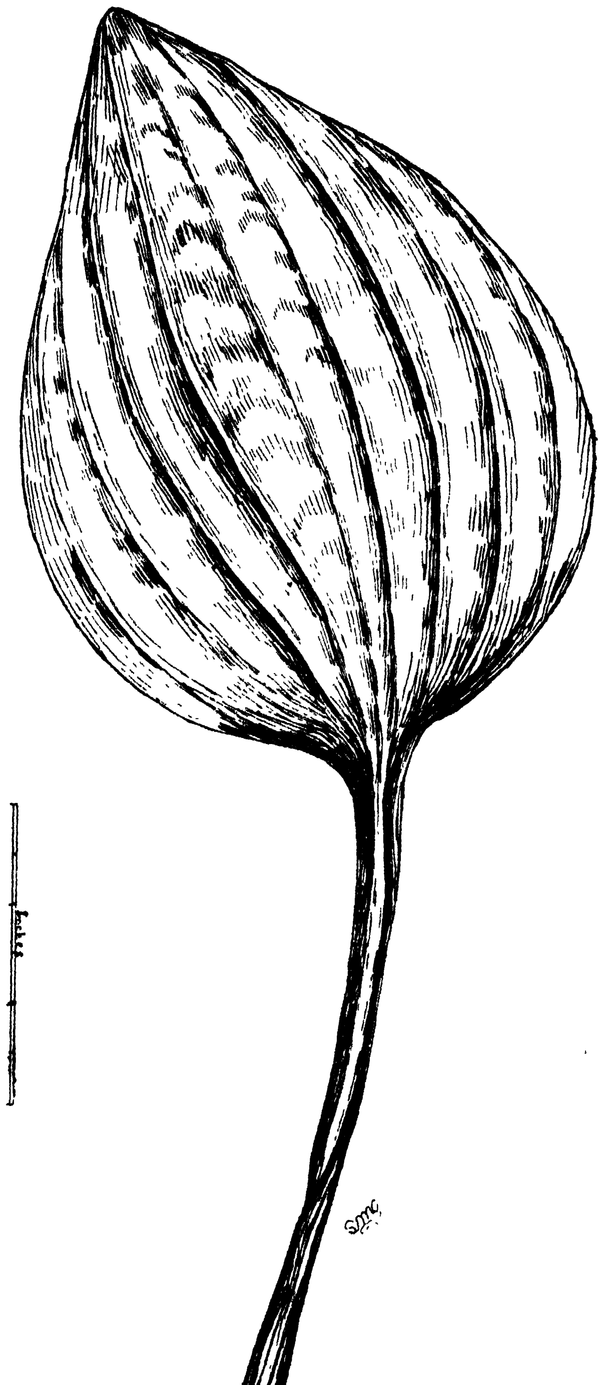


Plate 101. **South African Plantain.**

(*Plantago Dregeana* ?)

Differs from *P. major* in the much larger leaf and very long spike of seed-vessels. This species is common along stream banks in the Transvaal.

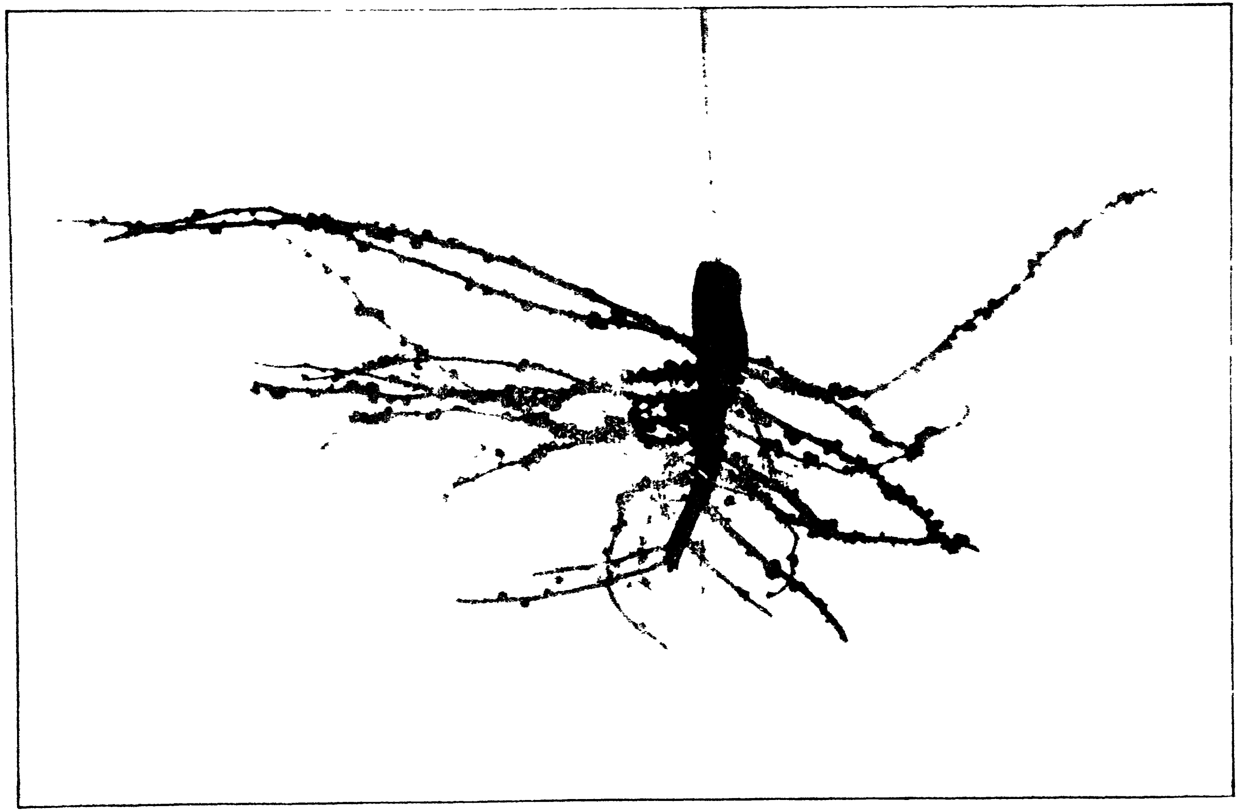


Plate 102. **Root Tubercles on the Pea-nut Plant** (*Arachis hypogaea* L.)

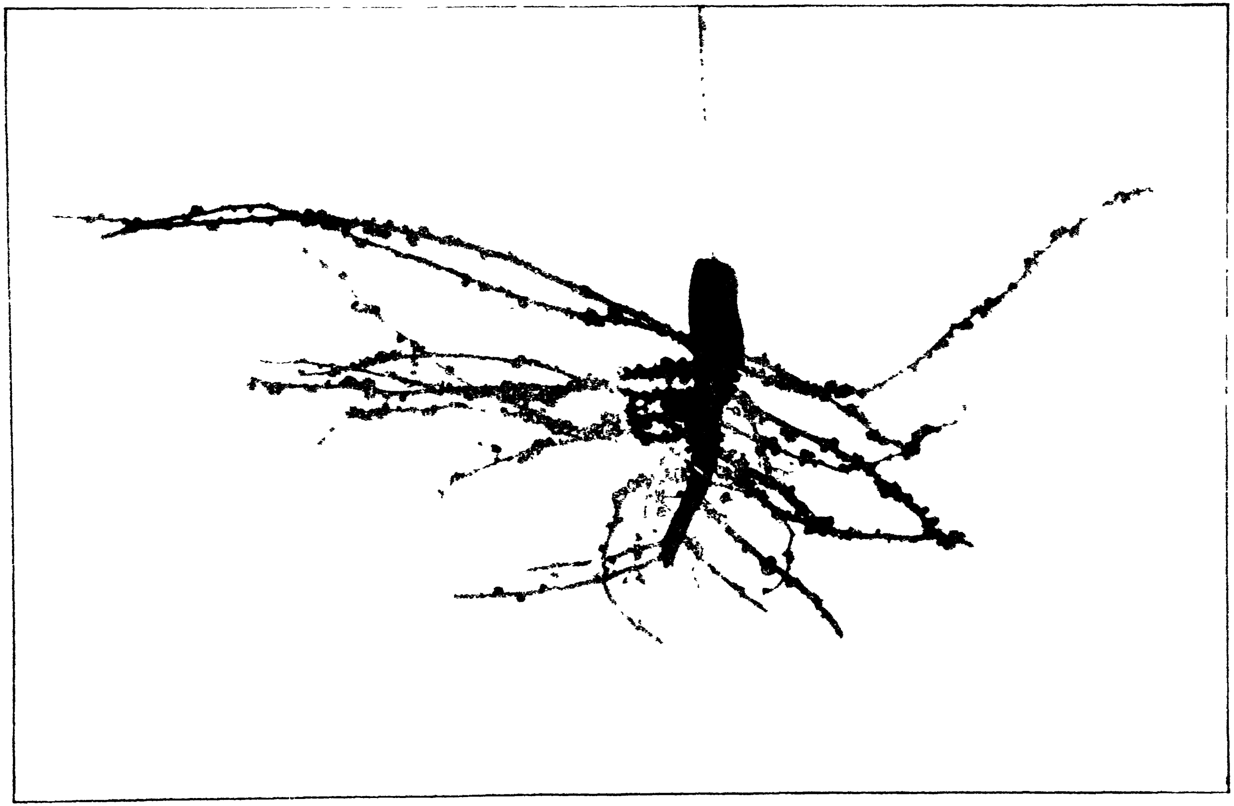


Plate 102. **Root Tubercles on the Pea-nut Plant** (*Arachis hypogaea* L.)

DESIRABLE CHARACTERS.

Increased yield of grain from each maize plant is one of the most important points for the South African maize breeder to work for at the present time. Many persons suppose that it is sufficient to sift out the largest seed from the bulk crop or to set aside the biggest ears; the biggest ears and the largest grain may owe their size to external influences such as manure, excessive richness of the soil, favourable moisture conditions, etc.; if due to such conditions we cannot expect these characters to be transmitted to the next generation. It is generally believed that acquired characters are not inherited.

But when we find that of two plants growing under precisely similar conditions as regards plant food and moisture, and neither of them attacked by insect or fungus pests, one produces a large ear yielding three-quarters of a pound of grain, and the other a small ear with only a quarter of a pound of grain, experience teaches us that these characters of relatively high and low yield are likely to be propagated, unless the tendency has been counteracted by cross-pollination.

By careful study of the maize plant we find that the production of big yields is dependent upon several factors, and it is necessary that we should know what these are.

Vegetative Characters.—A robust stem, vigorous growth of plant and plenty of leaf surface of a dark green colour are among the vegetative characters essential to the production of good yields, but further discussion of these points must be reserved for another article.

Ear and Grain Characters.—It is upon these characters that maize is judged at agricultural shows, and the following notes are intended as an explanation of and guide to the judging of maize.

A casual glance at a crop of harvested maize on the ear, ready for shelling, conveys but little idea of the amount of variation which occurs between the several ears in any one sort. But when one tries to find ten uniform ears in a heap of some hundreds, it is surprising how difficult it is. Experiment has proved that the presence of certain features in an ear is, in certain breeds, associated ("correlated") with heavy yield, while the absence of those characters is correlated with poor yields. We will therefore point out the desirable features in an ear to be selected for seed purposes.

Trueness to type or breed characteristics and uniformity of exhibit. Together, 10 points.

In a mixed sample of maize, composed of cross-breds or of several separate breeds, it will generally be found that one of the several types or breeds represented is better than the others, and therefore more suitable for the particular conditions under which they were produced. It must follow, therefore, that better returns would have been obtained had that type or breed only been grown instead of having grown, in addition, a number of inferior types or breeds. If it is desired to test the relative merits of different types or breeds, this could better be done by growing them in separate plots instead of mixing them in the same plot. The latter method tends to indiscriminate crossing and consequent lack of uniformity in the grain produced.

In judging the value of a sample, therefore, trueness to type or breed characteristics should be taken into account. Experience with the different standard breeds is perhaps the best guide in determining the purity of a sample.

Uniformity of exhibit refers to uniformity of the ears as regards size, shape, colour, indentation, smoothness, etc. The kind of shape or colour is not taken into consideration in scoring for this feature, but the ears of the sample should possess similar characteristics; they should present a uniform appearance. Place the uniform ears together, and if six ears out of the ten are fairly uniform, and four are distinctly different in general type, a cut of two points out of five should be made on the score card, and the sample will be marked three points. The shape and size should be uniform in the different ears of the sample. Their shape and size may be poor, but if they are alike they must be given the full marking under the head of uniformity. The poorness of shape and size will be dealt with under shape of ear and size of ear respectively.

Shape of Ears and Straightness of Rows, 10 *points*.

The shape of the ear has a good deal to do with the yield and quality of the grain. The ears should be of the shape that will conduce to proper maturity under the climatic and soil conditions in which the breed is grown, and will admit of the largest possible weight of shelled grain of the most valuable quality.

The most desirable shape is the cylindrical, having nearly the same circumference from butt to tip. On such an ear the grain will be more uniform in shape and size, and the total yield will be greater than on a tapering ear of the same length. Tapering of the ear is often caused by the loss of two rows of grain at about one-third of the distance from butt to tip. These incomplete rows not only produce poorly shaped ears, but cause the development of grains of irregular shape and size, and a smaller proportion of grain to ear.

But different breeds of maize show breed characteristics not only as to dentness but also in shape of ear; in scoring for shape, therefore, this fact must be borne in mind and the exhibit marked accordingly. Thus, Star Leaming has a slightly tapering ear, which, though less desirable than the cylindrical ear of Iowa Silver Mine, should not be marked down on that account.

Straight rows of grain permit of the development of a greater weight of shelled grain than twisted rows, therefore the rows should be straight and parallel with the cob. If they twist to left or right, or are irregular and crooked, such irregularity must be taken into consideration and a cut made according to the experience of the judge. Straightness of rows may be of lesser importance than size of ear. If the yield of grain is greater, other things being equal, the ear having greatest yield would be most desirable.

In judging shape, count the number of well-shaped ears, true to variety of type, in the exhibit, and cut according to the proportion of poorly-shaped ears, e.g. for four poorly-shaped ears cut the exhibit two points. The scoring for shape cannot be determined by written rules, but is a question of experience. The shape which is most desirable in one case may be undesirable in others.

It is possible that consideration of fancy shapes may lead to the development of unprofitable types. It is important, therefore, that the judge should realise the relation between shape of ear and the value of the ear.

Colour of Grain, 5 points; Colour of Cob, 5 points.

Red cobs are undesirable in white breeds, for the red chaff which adheres to the tip of the grain after shelling is said to discolour the meal. A white cob in a yellow breed is also undesirable, for the tips are dull in colour, and give a dull, aged appearance to the shelled grain. With the exception of "Golden King," "Hawkesbury Champion," and some of the yellow flint breeds, which have white cobs, a white cob in a yellow sample or a red cob in a white sample is considered an evidence of very careless selection, and should bar the sample. A yellow grain in a white ear, or a white grain in a yellow ear, is an evidence of cross-breeding, and should be scored down. The yellow grain in the white ear indicates that a stray pollen grain from a yellow breed has fallen on the silk and fertilised a kernel of white corn. The yellow tint may be very pale—scarcely noticeable unless carefully looked for, but it indicates crossing just as much as the darker yellow grain among the white.

For each cross-bred grain in an ear cut one-tenth point. All missing grains are assumed to have been removed by the exhibitor because of crossing, and should be cut accordingly.

Market Condition, 5 points.

By market condition is meant ripeness, soundness, firmness of kernels on the cob, freedom from injury and disease, and brightness of colour; in other words, the condition best adapted for marketing. Lack of ripeness or maturity in a dry ear is usually indicated by looseness of the grains on the cob, for the immature grain shrinks in drying, leaving it loose and movable. An immature ear has not had sufficient time, sufficient moisture, or enough sunshine to enable the plant to manufacture and store all the starch, protein, oil, etc., to fill the grain to its full capacity; consequently as the water dries out it leaves the grain coats not fully packed, producing a wizened or "chaffy" grain. Some breeds naturally have very rough ends even when the grain is fully developed; these must not be confused with grains which owe their roughness to lack of maturity.

In scoring maturity take up each of the ten ears carefully and give it a sharp twist; if it is mature it will remain firm; if immature it will twist loosely in the hand. Count the number of immature, chaffy, or diseased ears, and cut the sample one-half point for every one of them, i.e. for six such ears cut three points, allowing two out of five for that sample.

In judging at agricultural shows it is often difficult to obtain exhibits which have dried out properly and are, consequently, in market condition. In such cases the judge must make allowance for this, and score on a uniform comparative basis. In this climate ears which seem dry enough to harvest at the beginning of April have been found to lose up to 35 per cent. moisture by the end of the dry season. The relative percentage of moisture in an exhibit is estimated as closely as the experience of the judge will allow; in most cases a cut of 20 per cent. will have to be made on the driest exhibits shown early in April.

Vitality.—This is one of the most important characters of seed maize, and it is very important that a thorough test of it should be made. This can only be done properly by a germination test, which takes at least five days. Take three grains from each ear to be tested, one from the centre and one from near each end of the ear. Fill a plate about two-thirds full of fine sand, and pour water over it until the sand is wet all through and the water is running off the plate; allow the surplus water to drain off by standing the plate at an angle of about 45 degrees for a few minutes. Plant the grains point down and barely cover them with the sand. Mark the plate with numbers corresponding to numbers placed on the ears, so that if there is failure or weakness in germination, you may know which ears to discard. Turn a slightly smaller plate over the plate of sand to prevent too rapid evaporation of moisture, and keep in a warm place; examine every day and keep the sand moist. At the end of five days count the number of grains that have sprouted, and work out their percentage of the whole number tested; a 97 per cent. germination in five days is the standard of vitality for seed maize.

Tips of Ears, 5 points.

In the States of Illinois, Indiana, Kansas, and Nebraska, much importance is attached to the filling out of the tips of the ear, and this point is rated at a valuation of 10 per cent. of all points in judging. Some prominent growers and breeders, however, are inclined to the view that too close selection for well-filled tips may tend to shorten the average length of the ear and thus to reduce the yield of grain. Iowa judges only allow 5 per cent. for tip characters in their official score card. Maize breeding in South Africa is in such an early stage of development that the local standard length of ear has not yet been fixed for any of our breeds, and the writer, therefore, considers it undesirable to lay too much stress on tip characters until we know more as to their influence on yield of grain. He has, therefore, followed the Iowa score card in allowing only five points for these characters.

The silks at the tip of an ear mature last, and it therefore frequently happens that nearly all the pollen of neighbouring plants has been shed by the time the tip silks have exposed themselves. As a result, only a few of the silks at the tip will have been pollinated and the fertilized grains become irregular in shape and size, because they are not crowded for space. If properly fertilized the tips of the ears will be filled out with regular uniformly-sized grains, and no portion of the cob will project beyond the grains. If the cob does not extend beyond the grains, or if it is not fully filled out, it is an evidence of some irregularity in development, and should be marked accordingly; for every exposed tip one inch long make a cut of one-half point; for less exposed tips make smaller cuts, even down to one or two tenths. For irregular grains on the tip, cut according to degree of irregularity; the rows of grains should be carried over the tip in straight, regular order.

Damaged tips are often due to weathering and insect attacks, through the ear-sheath being too short to cover the tips properly. In field selection, therefore, ears with tips protruding from the husks should be discarded for breeding purposes.

The season, also, has some influence on the development of the tips; more well-filled tips are developed in seasons of frequent sunshine between showers than in seasons of long-continued rains like the one through which we have just passed.

Breeds having characteristically short ears are likely to produce better-filled tips than breeds having large, long ears, grown under similar conditions. But it is essential that we bear in mind our object in selecting seed ears, viz., the production of the greatest amount of grain per acre; if long ears, not covered with grains over the tips, give the heaviest yield, this type of ear is most desirable, and should be scored accordingly. The cob is merely the axis on which the grains are carried, and our investigations last season showed that, other things being equal, the larger the cob the more grains can be developed on it.

However, as between two ears of the same size, grown under similar conditions and for similar purposes, one having the tip well covered with uniform, regular kernels, is certainly more desirable than one having the tip uncovered. In most cases of badly filled tips, their grains are small, irregular, and often having poor vitality; therefore such tips should be cut more severely than if all the kernels were of the regular, uniform size and shape.

If such poorly developed grains occur in the seed ears, they should be removed before planting.

Butts of Ears, 5 points.

It is often found that the butts of the ears are badly covered with grains, or swollen, and bearing grains of irregular shape and size. Such irregularity reduces the yield of grain and tends to irregular planting owing to blocking of the planter. This has led to the practice of removing the butt grains before planting.

The rows of grain should extend in regular order over the butt and around the shank or ear-stalk. Poorly covered butts are mainly due to the fact that when the silks from the butt appeared, there was not sufficient pollen to cause their fertilization. In most breeds, however, the pollen matures before the silks; consequently we find a larger proportion of well-filled butts than of tips.

When the shank of the ear is broken off at harvest or in husking, the depression which is left should be regular. If the grains are not filled out around the shank the yield of grain is smaller, and the shank is usually found to be too large and strong, which interferes with husking, as it is difficult to break off very thick shanks. This filling out of the grain around the shank may be too highly developed, however, weakening the latter so that the ear breaks off before harvest and is lost or damaged.

A large butt, poorly covered, is usually associated with an excessively large cob, which will be exceedingly wet at harvest, causing the ears to dry slowly, and increasing the risk from frost. The cold weather freezes the water in the cob and grain, and thus expands and bursts the cell walls in the embryo, reducing the vigour or even destroying the life of the embryo plant.

Size of butt depression is a breed characteristic, and must be scored accordingly. In scoring butts a very poorly filled butt, on which the grains do not cover the end of the cob, should be scored one-half point. If the grains cover the cob, but are flat, shallow,

and irregular, cut three-tenths point. If the grains are regular in size, but do not swell out beyond the cob, cut two-tenths point. In the case of grains swelling out beyond the cob in an irregular manner cut one-tenth point. If the grains are swelled about the shank in regular manner, leaving a concave depression, allow full points.

In exhibiting ears at shows trim out with a knife all traces of the shank: it adds greatly to the appearance of the exhibit and is perfectly legitimate.

Uniformity of Kernels, 5 points.

The length, shape, and thickness of the grain varies more or less with the breed, but whatever the shape and size of the grain in an exhibit, it should be uniform; if the breed has rough grains, all the grains should be rough, or vice versa.

To determine uniformity take out two grains from each ear at about one-third the distance from the butt to the tip; place them on the table directly in front of the ear from which they were taken, with tip of grain pointing towards the ear; in this position the comparative shape, size, etc., can easily be determined. Observe the ear carefully to see whether the grains are uniform in all parts of the ear; in some ears it will be found that the ears are very irregular in surface owing to unequal length of grains. Count the number of ears having generally uniform grains, and score in proportion to the number of uniform grains, e.g. if there are five ears with uniform grains, mark the sample 2½ points for uniformity. (See Plate 94.)

Shape and Length of Kernel, 10 po.

Shape and length of grain are, within certain limits, breed characteristics, but within the limits of any one breed there may be great variation in both these characters. The ideal shape for each breed can only be learned by experience. Shape of grain has an important bearing on both yield and quality; well-shaped grains pack more evenly on the cob and more of them are carried than on an ear of the same size producing irregularly shaped grains. Of two ears of the same size, the one bearing long, wedge-shaped grains (Plate 95, fig. 8)—other things being equal—produces a larger amount of more nutritious grain than the one which bears broad, short grains; the former may carry 800 or 1,000 grains as compared with the 400 or 500 of the latter; as each grain bears only one embryo, and as the embryo end of the grain is the richest in oil and protein, it follows that the ear bearing 1,000 grains (if well filled and fully developed) produces more nutriment than the one bearing 500 grains, even though of much larger size. Eight-row Hickory King, Golden King, and similar breeds have broad, short grains, which are characteristic of the breed, and therefore should not be scored down on the ground that they are not wedge shaped. But, generally speaking, the ideal type of grain is wedge shaped, with straight sides, as it permits of the greatest possible amount of grain to cob; the tips of the grains are arranged on the cob in regular order, and the wedge shape and straight sides allow them to fit snugly together from the point to the crown; curved sides leave unnecessary furrows between the rows both above and below. On this account, also, the slope should not taper to too sharp a point.

Regularity in thickness (as contrasted with width) of grain is also important; grains with thin, sharply pointed tips usually have small embryos, or are often lacking in vitality, and the plants grown from them have poor constitution. They also tend to relatively low yield if there is too much space left between the tips as they stand upon the cob. Grains with thin tips are usually low in oil and protein content. The tip should therefore be plump, having about the same thickness as the upper portion of the grain.

Length of grain is of greater importance than width, because increased length increases the yield without reducing the number of rows or of grains. The popular fallacy that a thin cob is a desirable characteristic of a good ear probably originates from a misconception of the actual facts. Investigation shows that heavy yields are associated with relatively thick cobs; the larger the amount of grain produced the larger must be the cob which has to carry it. But of two ears of equal circumference, the one having the longest grain in proportion to cob diameter is the most desirable, because it yields the largest amount of grain. Thus it is not thinness of cob that is the desirable feature, but length of grain.

In judging shape of grain, count the number of grains of desirable shape in the ten pairs that have been taken out for study of uniformity, and mark accordingly, i.e. if there are eight pairs of desirable shape, allow four points for shape. Mark in the same way for length, i.e. half a point for each ear showing grains of desirable length. For intermediates either in shape or length, cut one-tenth or one-quarter as experience dictates.

Length of Ears, 10 points.

Leuth of ear has an obvious effect on yield of grain. But it is generally recognised that a certain standard length for each recognised breed gives the best returns. It is therefore the usual practice to cut for excess of the standard of length, as well as for deficiency. The measure is taken from extreme butt to extreme tip, and a foot-rule, held with both hands, is the most satisfactory measure to use. As the rule is drawn from ear to ear of the sample, it is easy to keep in mind the amount each ear is shorter or longer than the standard. The excess is added to the deficiency, and for every inch so obtained a cut of one-half point is made from the total of ten points for the ten ears.

Circumference of Ears, 5 points.

Measure the circumference of the ear with a tape line at about one-third the distance from the butt to the tip of the ear. The excess and the deficiency of all ears not conforming to breed standard is added together, and for every inch thus obtained a cut of a quarter point should be made from the total of five points for the ten ears. The approximate proportion is as $7\frac{1}{2}$ to 10 or 8 to 12 inches.

In order to do this easily and with as little loss of time as possible, the ear should be picked up with the left hand and the end of the tape held with the index finger of that hand at the proper point; then quickly arrange the tape round the ear and note the excess or deficiency as compared with standard.

Space between rows, 5 points.

There are two kinds of spaces between rows that must be taken into account—one, the sulci or furrows between the tops of the rows

of grain; the other, between the tips of the grains about the point where they are attached to the cob. It is obvious that if the grains are not broad enough to fill out the space between the rows, the ear must carry less grain than could otherwise be the case. Wide furrows are therefore undesirable, and should be bred out. The following rule must be applied with discretion:—For furrows over $\frac{1}{16}$ inch wide, cut one point for each ear; for furrows $\frac{1}{32}$ to $\frac{1}{16}$ inch, cut one-half point; for furrows less than $\frac{1}{32}$, make no cut.

To examine the spaces between the tips of the grains it is generally necessary to remove about four rows of grain for 3 or 4 inches of length. This can be done at the time, and on the ears tested for percentage of grain to cob. First examine the sides of the ears, and if there is too much space the openings between the tip sides of the kernels can easily be detected. Then turn the ear so that one end points toward you and examine the ends of the rows; any excess of space between the rows at the points of the grains can then be seen easily. Such space is undesirable, as it indicates poorly shaped grains, lacking vitality and adequate nutriment.

Yield and Percentage of Grain to Cob, 15 *points.*

When maize is sold on the cob, as in the United States, the percentage of grain to cob is of great importance, but where only shelled grain is sold, as in South Africa, this point has less significance. My investigations show that percentage of grain to cob is not the best guide to highest yield of grain, which is one of the most important desiderata. I have, therefore, divided the score of 15 or 20 points allowed for this character by American breeders, giving 10 points to yield of grain per ear, and 5 points to percentage of grain to cob.

Both characters are determined in the same way. Take every alternate ear in the sample; weigh the five ears; shell off the grain; weigh the five cobs; subtract the weight of cobs from the weight of ears, and the weight of grain will be obtained; divide the weight by five, and the average will be obtained. For every half-ounce below the standard for that breed cut one point. To find the percentage of grain to cob, divide the weight of the grain by the total weight of the five ears. For every per cent. below the standard cut one-quarter point.

III. NOTES FROM THE ECONOMIC HERBARIUM.

By Joseph Burtt-Davy, F.L.S., Government Agrostologist and Botanist, and Miss S. M. Stent, Herbarium Assistant.

(1) Poisoning with the Kaffir Gift-boom (*Acokanthera venenata*). (Plate 96.)

At various times small pieces of wood and bark have been submitted for determination as part of the material suspected in cases of criminal or accidental poisoning, but though the wood resembled that of *Acokanthera*, and the circumstances of the case pointed to the use of that drug, the samples were too small and incomplete to make an exact determination possible.

In December, 1908, the District Commandant of Transvaal Police, Pretoria, sent for identification a foliage branch and piece of the bark of a tree which had caused the death of a native at Scheerpoort, near Pretoria. The deceased is stated to have scraped the bark and, mixing

the product with water, to have drunk the decoction; he died within 45 minutes. In this case the material was sufficient to enable us to recognise the plant as *Acokanthera venenata*, the gift-boom of the kaffirs, and the most poisonous plant known to them.

Professor P. MacOwan, late Government Botanist of Cape Colony, whose long experience and intimate knowledge of the economic botany of South Africa are unrivalled, writes of this tree:—"I had to identify it in a case of unintentional poisoning at Grahamstown in 1868, when the kaffir doctor who had administered it seemed amazed that any exception should be taken to the use of the drug. . . . The active principle of *Acokanthera* is a not too stable glucoside, and is consequently upset by ebullition with water; it is best to extract by strong alcohol."

Natives use it is a cure for snake-bite, but, being a dangerous remedy, it often has fatal results. Its most important use is poisoning of arrow-heads. According to Andrew Smith, the natives extract the poison by boiling down the powdered bark till the liquid is of the consistency of a brown, sticky syrup. It is then mixed with the fresh juice of a Euphorbia and smeared on the arrow-heads.

Dr. Smith further describes the poison contained in the plant as brucine, an alkaloid allied to strychnine, but recent tests in the Botanical Laboratory with a strong alcoholic solution of the bark: failed to reveal the presence of brucine, or of any other alkaloid. Other species of *Acokanthera* have been examined chemically by the Imperial Institute and found to contain glucosides, and it is therefore more than probable that *A. venenata* contains a similar toxic principle.

Description of the Shrub.—*Acokanthera venenata* (family Apocynaceae) is a rigid, compact shrub from 4 to 14 feet in height, with stiff dark green leaves up to 2½ by 1¼ inches, smooth and shiny, and arranged opposite to each other on the branches, the under surface being as a rule paler and sometimes tinged with purplish red. The shape of the leaves varies from almost round and flattened at both ends to distinctly oval and narrowing at base and tip; in all cases the middle vein is continued beyond the tip into a short, sharp point. When not in flower this shrub can be distinguished from species of the family Rubiaceae, with which it is sometimes confused, by the absence of stipules (scale-like bodies) between the leaves. The flowers are small, white tinged with pink, and are borne in dense clusters between the short leaf-stalk and the branch. They have the strong, sweet scent of the jasmine and are very attractive: they appear in November. The shrub grows among rocks on kopjes, and is sometimes seen covered with mistletoe. (See Plates 96 and 97.)

Strophanthus speciosus, an indigenous shrub, also contains a poison believed to be used by natives for the poisoning of their arrow-heads, and the Oleander tree (*Nerium oleander*), so commonly cultivated as a garden hedge-plant for its beautiful pink or white flowers, is also highly toxic. Both belong to the same family of plants.

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(2) Suspected Poisoning of Poultry by Eating Pig's Ears or Varken Ooren (*Cotyledon orbiculata*). (Plate 98.)

Cotyledon orbiculata (family Crassulaceae) is said to be poisonous and to have caused the death of fowls in Pretoria. A lady having too

much of this plant in her garden thinned it out, and, thinking it was a form of aloe (family Liliacea), which is considered healthful for stock, chopped up the discarded ones and gave them to her fowls. The next day six valuable hens were dead, and the others very ill. A neighbour then told her of a similar experience with the same plant. The symptoms were those of narcotic poisoning, the fowls exhibiting great stupor. The use of a stimulant, such as whisky and water—one part of each—was recommended by the Veterinary Division (dose, one-half teaspoonful every three hours till the symptoms disappeared), and is reported to have proved beneficial.

In a list of poisonous plants of the Cape, sent to us by Mr. Walsh, of Capetown, this plant is included. We shall be glad if any readers of the *Journal* will report any other cases of poisoning from eating it.

The plant has thick, succulent, greyish green leaves, with narrow red margins, long flower-stalk terminating in a loose cluster of red tube-shaped nodding flowers.

Since the above was written Dr. Theiler has fed some of the material to two hens, and reports that both died, with symptoms of paralysis preceding death.

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(3) THE CAPE DUBBELTJE-DOORN (*Emex centropodium*). A NOXIOUS WEED NEW TO THE TRANSVAAL. (Plate 99.)

As will be seen at once on reference to the plate, this plant is quite different from the one known to the Transvaal farmer as Dubbeltje-doorn (*Pretrea zanguebarica*), and which was figured in an early issue of the *Journal*. The Cape Devil's Thorn, or Dubbeltje-doorn, is a native of the coastal region of Cape Colony and Natal, to which region it was confined until recently. It has now spread from the coast to the interior, probably in the wool of sheep or hair of goats, and has been found near Pretoria, at Ventersdorp, and in abundance near Christiana.

Mr. J. Medley Wood, Director of the Natal Botanic Gardens, Durban, figures this plant in his illustrated book called "Natal Plants," and describes it as a troublesome weed known to young people as 'Devil's Thorn.' As the seed vessels lie on the ground, one of the thorns is always erect, or nearly so, therefore likely to inflict painful wounds, and the plant would most likely become a pest in sheep-farming districts; but, fortunately, it is almost entirely confined to coast districts, though I have met with it at an altitude of 2,000 feet." Mr. Andrew Smith, M.A., in his work on medicinal plants of Cape Colony, says of this plant: "The leaves are boiled and used as a cabbage in biliousness, and also for creating an appetite. They are mildly purgative and diuretic."

Description.—*Emex centropodium* is a prostrate plant spreading over the ground; it is quite smooth in all parts. The stems, which reach to a length of 3 to 4 feet, are green and ribbed; the leaves are arranged alternately on the stems, and vary in size from 2 to 7 inches long and from 1½ to 4½ inches wide. The thorny seed vessels are borne in clusters (or sometimes singly) between the base of the long leaf stalk and the stem. These three-sided seed vessels are hard and woody, and bear three sharp points or "doorns." The male flowers are very small and green, and are arranged in interrupted spikes on the branches.

(4) Dysentery Plant or Naald-Bosje (*Monsonia biflora*, DC.). (Family Geraniaceæ.)

The "Naald-bosje" is a small shrubby, herbaceous plant growing pretty freely in most districts of the Transvaal; it has small leaves and purplish blue flowers. The arrangement for the distribution of its seeds is peculiar to members of the geranium family, to which it belongs. The seeds are enclosed in five seed-bearing vessels, each of which terminates in a long, fine bristle or beak.

These seed vessels, with their bristles, are attached to a central column, and form the curious needle-shaped fruits that give the plant its name. When ripe the vessels break away from the common axis, the bristles separating from the point and curling into spirals. The wind catches them (the bristle and vessels being supplied with long white hairs, which assist in this respect) and bears them far away from the parent plant. Moisture causes the bristle to straighten itself, and the uncoiling of the spiral produces a boring movement that forces the seed into the earth.

This plant is well known for its medicinal properties, and is used in cases of dysentery, etc. A simple decoction made by boiling it in water is often used by farmers for this purpose and for snake-bite. For the former, the decoction is taken internally, and for the latter it is applied to the wound externally as well. Natives also make use of the plant medicinally.

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(5) Toowoomba Canary Grass.

A winter pasture grass has recently been much advertised in Australia and South Africa under the name of *Phalaris commutata*. Seed from Australia has been sold at very high prices, and the plant has been tested on a limited scale in Natal, Cape Colony, and the Transvaal with promising results. Owing to the high price charged locally and in Australia for seed of this grass, there has been a tendency to try to secure it from Europe, and it is desirable to issue a warning against buying European seed under that name.

There appear to be two European grasses which have at one time or another been known under the name of *Phalaris commutata*. One is the grass now known in Europe as *Phalaris coerulescens*, a comparatively useless sort. In the other case the name was given to an herbarium specimen consisting of the roots of *Phalaris bulbosa* and an inflorescence of *Phalaris minor*. So that there is not at the present time any grass known in Europe under the name *Phalaris commutata*. A European seedsman receiving an order for seed of *Phalaris commutata* would enquire from a botanist what European species went under that name, and, finding that it was synonymous with *Phalaris coerulescens*, would send seed of that species, which would probably prove disappointing.

The question next arises, what is the proper name of the grass which is said to be giving such good results in Australia, if it is not *Phalaris commutata*? Our own plants at Skinner's Court have not flowered, so that we have not been able to investigate the point for ourselves. But the Government Botanist of Victoria, Dr. A. J. Ewart, has submitted specimens to leading European authorities, one of whom pronounces it to be an undescribed species, for which he proposes the name *Phalaris stenoptera*. Others, again, consider it to

be identical with *Phalaris bulbosa*, a perennial species of the Mediterranean region. In Queensland specimens grown under the name *Phalaris commutata* proved to be *Phalaris arundinacea* and *Phalaris bulbosa* respectively, while in some cases the ordinary Canary grass, *Phalaris canariensis*, has been received under the same name.

These points indicate that the so-called *Phalaris commutata* may be a hybrid which tends to split up into its original parent types. In any case, the name *Phalaris commutata* is untenable and should be discarded, and the name *Toowoomba Canary Grass* might with advantage be substituted.

Reports from the different Australian experiment stations are very conflicting, as to the utility of this grass for grazing and fodder purposes, but on the whole it is agreed that it grows well in winter, and up to about December, when it seeds. The stems are then rather hard, so that if it is to be used for hay it must be cut early, while fresh and green. The flat, succulent leaf is said to be readily eaten by stock, including sheep. Since the plant is perennial and seeds freely, it should maintain itself well, even with continual grazing.

But it has still to be proved that it is superior to all or any of the grasses already known and in common use. If it proves to be identical with *Phalaris coerulescens* or *Phalaris bulbosa*, experience with these grasses leads us to doubt its value for South Africa. Until we have more information about it, from tests now being conducted, we would advise farmers not to go in too largely for seed of the *Toowoomba Canary Grass*.

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(6) MEDICINAL PROPERTIES OF THE PLANTAIN (*Plantago major L.*) (Family Plantaginaceae.) (Plate 100.)

A correspondent writes:—"My attention has been drawn to the letter of Mr. Pape (in the daily press) recommending the plantain herb (*Plantago major*) as a cure for malaria. Before trying it I will be glad if you can kindly advise me what are the active principles of this herb, and if anything is known about its physiological and therapeutic actions." The following notes may be of use to some readers of the *Agricultural Journal* who wish to try this remedy.

Plantago major is a native of Europe, and occurs sparingly as an alien weed in South Africa, where it has been accidentally introduced with garden seeds. It is occasionally met with on the borders of garden water-furrows in Pretoria, Potchefstroom, adn a few other places. It will be familiar to those who have once lived in Europe under the names of rib-grass, rib-wort, ripple-grass, wegereich (German), or plantain (French).

According to Wood, Remington, and Sadtler (*United States Dispensatory*, 18th edition), the leaves are saline, bitterish, and austere to the taste; the root saline and sweetish. It was formerly considered refrigerant, diuretic, deobstruent, and somewhat astringent. The ancients esteemed it highly, "but it is at present never used, except it be externally in domestic practice as a stimulant application to sores." The leaves are put on whole or bruised in the form of a poultice. *Plantago media* and *Plantago lanceolata*, or rib-grass, possess properties similar to those of *P. major*, and may be used for the same purposes.

Theo. Keller, in 1868, obtained from the leaves of these three species chlorophyll, resin, wax, albumen, pectin, citric acid, and oxalic acid. David Rosenbaum found in the leaves of *P. major* wax, chlorophyll, resin, and a notable quantity of calcium oxalate (*Amer. Journ. Pharm.*, 1886, p. 418). J. F. Strawinski found in the rhizome a substance which he believes to be either phlobaphene or protocatechuic acid (*Amer. Journ. Pharm.*, 1898, p. 189).

Semen psylli are the seeds of several species of European plantago. They are small—about a line long by half a line in breadth—convex on one side, concave on the other, flea coloured, shining, inodorous, and nearly tasteless, but mucilaginous when chewed. They are demulcent and emollient, and may be used internally and externally in the same manner as flax seed, which they closely resemble in medical properties.

For differences between this and the wild South African plantain see Plate 101.

The Forestry Section.

INSTRUCTIONS ON OSIER GROWING AND PREPARING FOR THE BASKETMAKER.

By J. S. Ingle, Instructor, Basket School, Vrededorp.

Cuttings or Sets.

Cut from the plantation in winter stout rods of two years' growth. These should be cut towards the beginning of the opening summer, but before the sap begins to rise and so cause the bark to peel off easily.

These rods should be cut into lengths of about 12 inches, discarding the top of the rod from the joint where it divides into yearling twigs. Plant in rows 8 inches apart and 16 inches from row to row. About three-quarters of the set should be beneath the surface.

The object to be attained in osier growing is to produce a long, solid, straight, and gently tapering rod of one year's growth, but new sets are best left for two years to ensure stability and health in the plant, after which they may be cut each year till the plant —which will become a large head growing sometimes forty or fifty rods—reaches the age of about twelve or thirteen years, when it is best to stump up and prepare the soil for new sets.

As experience will do more for the grower than any essayist could possibly do, I will proceed to describe rather more minutely the processes of cutting, trenching or pitting, peeling, drying, tying, etc.

Cutting.

Osiers must be cut by hand, and as the sap rises in each set at about the same time the difficulty arises of dealing with them simultaneously; a week's or a fortnight's delay often means that the rods will become what the basketmaker terms "double-skinned," when they would be best left for two years, or dried off with the bark on for very common work. Cutting then should commence when the osiers have well hardened after the fall of the leaf.

They should be carefully cut with a large hooked knife or small strong sickle, and care should be taken that only one cut is made, close to the stump. In cutting a plantation each cutter takes 1 row, dropping the osiers behind him as he proceeds. For every three or four cutters a man should be told off for banding.

The bundles of green osiers should be neatly and evenly tied with the butt ends together, and batted level. Each bundle should be about 40 inches in girth banded with two tight green osier bands. All osiers, whether peeled or unpeeled, should be banded with green osiers; on no account should wire or string be used, as the wire cuts and spoils the surface of the rod, whilst the string always slips and allows the bundles to become untidy and broken.

The green osier band is made by twisting a loop in the top of a green rod through which the butt end is passed after encircling the bundle. The butt, after being pulled quite tight by leverage obtained by pressing the bundle with the foot or knee, is in turn twisted until a fold is formed, so preventing any loosening of the band, after which the end is simply tucked away in the bundle.

TRENCHING

To explain the object of trenching I must mention what has probably been obvious to those engaged in osier growing, viz., that the osiers already cut will not peel. To enable them to do so it is necessary to place them in trenches or furrows of water till they sprout. Trenching then permits the cutting to be quickly proceeded with and the osiers to mature in the water, from which they are taken in large quantities and given to the little army of women and children who are engaged to do the peeling.

The trenches may be dug in the banks of a dam or river, or the bed of a stream may be used. The bottom should be made of earth, and fairly solid, the water being about 18 inches deep. The bundles must be placed upright in the water and as close together as possible. The time they should remain in the trenches must be determined by testing. When the new leaves have begun to appear they must be watched. As the new sap rises it loosens the bark from the white rod inside, and this is the time for peeling.

The trenches may be of any size convenient to their locality, and hundreds of bundles may be trenched together.

SECOND CUTTING.

The later osiers to be cut will often peel without being trenched, but if after cutting there is difficulty in peeling, or should it be necessary to store the green osiers for a day or two on account of the peelers not keeping pace with the cutters, the best plan is to lay the bundles in stacks of five or six tiers crossing each other, lay on a thick thatch of peelings and keep drenched with water. Stacks like this, however, must be carefully watched as they are apt to get heated and rendered valueless.

PEELING.

Osier peeling in England is usually done by women and children at a small sum per bundle. One woman, with a child to assist her, will, when she is used to the work, peel five and sometimes six bundles a day, but great care must be exercised in the oversight of the work to see that the "brakes" are so adjusted that the peel may be rent from butt to top without the white rod itself being smashed in the process.

Very small osiers, if carefully prepared, are valuable, and generally command a good price, but often for want of a little more care in the peeling these little rods that might have been used for the very best work are found to be fit for little else but working, three or four at a time, into the sides of the commonest baskets.

When the cut osiers are bundled in the plantation, all sizes and lengths are tied up together, but the peeler should be taught to lay them according to their size in three heaps and so save the need

of sorting afterwards. Frequently the basketmaker, who may only need one size, has to buy much that he does not require to get that size.

DRYING.

The newly-peeled rods must not be allowed to lie long on the ground, nor should the ground be of a nature to soil the moist surface of the rod. Unless the ground is covered with turf, it is a good plan to spread peelings for the rods to lie on until they are gathered up for drying. Treading upon the rods should also be carefully avoided; a rod may often be damaged either in this way or by a too tight "brake," and seem to be quite sound when dry, but when the basketmaker has soaked the rod for working he soon discovers the mischief. Some one should be continually going round the peeling-ground gathering up the peeled osiers and standing them upright between poles or tressels, according to their size, until they are quite dry.

The peeled osiers do not take long to dry off, but as it is imperative that they be quite dry before tying in bundles again, it is best not to be too hurried but to let them remain a few hours longer than may seem necessary. In dry weather rods peeled one day may well be bundled the next.

The white osiers are best tied up in bundles of not more than 3 feet girth at the bottom band. When sufficient rods are put together for a bundle, a good strong green osier band should be placed round them, after the manner already described, as near to the butts as possible. Then with a good strong wooden bat—a piece of 1½ inch wood cut in the shape of a tennis racquet is best—the butts should be beaten level and so driven further into the band, thus tightening it. Another band should then be joined to the first on one side of the bundle, pulled very tightly down under the butts, and carried up the other side and again made fast to the band. Two more bands should then be placed on the bundle above the first, about equi-distant, but if the rods are very long four bands are necessary.

It will be noticed that in drying the greater number of rods will curve into a bow shape. A popular error is to lay the curves all one way in bundling, thus making a curved bundle. This in its way is as great a trouble to the basketmaker as twisted floor boards to the builder. Imagine these curved rods being required for uprights for a hamper or other basket two or even three feet deep. There may be as many as fifty or sixty required, and each of these, when the basket is finished, must be perfectly straight; but the rods retain their curves and incessant labour is needed all the way up the basket to bring them into shape. This difficulty is overcome by allowing all the curves to point outwards when the first band is put on round the butts, and pulling the rods straight with the middle and top bands. This makes a good straight bundle, and although the rods seem quite dry yet they are not set as they will be after about two months' seasoning, when they are fit for work and will come out of the bundle nicely shrunk and straight.

STORING.

White osiers should be stored in a perfectly dry and dark room or shed. It is not well to place them on rafters under a hot roof

as the heat dries so much of the sap out of the rod that it becomes too brittle. Darkness too is best for them, as too much light spoils the colour by turning them yellow.

Buff Osiers.

Osiers for buffing require no trenching, and should be cut during the winter while the sap is down. It is best to tie the green rods in very small bundles for boiling, say, about 8 inches in diameter. The boiler should be about 10 feet long, 21 inches wide, and 16 inches deep, and set in brickwork over a furnace. It is better to have two boilers if much buffing is to be done, as it is necessary to peel the osiers when hot out of the boiler. These boilers should be provided with flat edges turned inwards, under which pieces of wood about 2 inches square and rather longer than the width of the boiler may be placed obliquely to keep the osiers under water. The boilers should also be provided with short wooden lids about 30 inches long.

After carefully packing as many osiers as possible into the boiler press well down with the pieces of wood above mentioned, and fill to the brim with water. By careful management it will be found that the stumps which it has been necessary to dig out to make room for new sets will provide nearly all the fuel required for the furnaces.

The osiers will need to be boiled for five or six hours according to the nature of the rod. By drawing a rod and peeling it one can easily tell when it is sufficiently boiled, but it must be remembered that it will dry lighter in colour, so it should be boiled to a good deep buff. As the bundles cannot be manipulated in the boiling water, they should be carefully removed when finished, and placed in the other boiler, in hot water, to get ready for peeling, which is done by means of a wooden hand-brake. Very little pressure is required to remove the shrivelled skin of the boiled osier, so these "brakes" are simply pieces of green wood about 8 inches long and 1 inch thick, with a slot cut down the middle about two-thirds of the length. Larger "brakes" are used for the larger osiers. When peeled the buff osiers should be dried off and stored in the same way as the white ones.

The Entomological Section.

I. SILKWORM CULTURE IN THE TRANSVAAL.

By David Gunn, Acting Government Entomologist.

On account of the great interest which has been aroused in connection with the culture of the mulberry silkworm in the Transvaal, during the past two years, it has been considered desirable to give a review of what has already been accomplished in the fostering of this industry, and also to give information regarding the proper methods to be used in the rearing of silkworms which may be of use to those who intend to prosecute this industry in the future.

Historical.

The silkworm industry originated in China, and history relates that it probably existed in that country about the year 2640 B.C. According to historical accounts it appears that the Empress Se-Ling-she, who evidently had remarkable inventive capabilities, commenced this very important industry. She is stated to have personally devoted her time and talents to the encouragement of sericulture, and is also credited with the invention of the loom for weaving silk. The ancient records of China, which are voluminous regarding this subject, testify to the fact that sericulture received the patronage of many noble families, and was encouraged to such an extent that it latterly became one of the most important industries of that country. Its secrets were, however, so jealously guarded that hundreds of years elapsed before a knowledge of it spread to western countries. The production of silk was prosecuted so vigorously that, before the introduction of cotton from Europe, even the poorest peasants in China were clad in silk of native production. The Chinese found it, however, to be impossible to permanently retain the secrets appertaining to sericulture, and ultimately a knowledge of it was obtained by the enterprising Japanese in the early part of the third century, who employed it to the very best advantage. At a later period a knowledge of the working of silk was gradually disseminated in India, and afterwards in Central Asia and the eastern part of Europe. It may be interesting to note that it was not until the year 1585 that the manufacture of silk was introduced into England; in subsequent years the industry encountered numerous vicissitudes, and it cannot be stated to have ever been firmly established in that country.

During the past few hundred years many monarchs and other potentates have persistently endeavoured to stimulate the silkworm industry within their dominions, and strenuous efforts in this direction are at the present date being made in Japan, China, India, Russia, Italy, France, America, and other countries. It appears, however, that artificial stimulation has met with persistent failure in many instances, principally due to the important fact that this industry cannot be placed upon a permanent and successful commercial basis in any country where labour of a suitable class is

not both cheap and abundant. This idea is amply confirmed by the fact that Japan, China, and Italy are, at present, the greatest silk producing countries in the world, and that in these countries labour is not only cheap and abundant, but the peasant class who engage in the industry are also exceptionally persevering, frugal, and industrious. So long as silk clothing is used for the gratification of feminine vanity, sericulture will remain an important industry.

General Directions.

Before proceeding to give a description of the methods used in connection with the rearing of silkworms, it is considered advisable to state here that the leaf of the mulberry is the natural and most nutritious food for the silkworm. There are several varieties of mulberry, but the white mulberry (*Morus alba*) has been found to be the most suitable food, and hence is the variety which is recommended to be used for this purpose.

The following information regarding the culture of the mulberry, which has been kindly prepared by the Acting Conservator of Forests, is given for the benefit of those people who intend to commence sericulture:—

"Methods of Propagating the Mulberry.

"There are two ways of propagating mulberry trees:—

"1. By seed.

"2. From cuttings.

"1. The seed should be sown broadcast in a well-prepared bed and then covered with a thin layer of sand. If the seed is sown early in spring, the seedlings may be planted out into nursery lines during the rainy weather before Christmas, but it is advisable to leave them in the bed until the following winter when they can be planted out where they are required.

"2. Mulberries strike very readily from cuttings, and this is the easiest way of propagating them.

"Cuttings 12 inches long should be made in July or August when the growth is dormant. In making the cuttings it is important to cut the wood to within a quarter of an inch of a bud at each end. If the cuttings cannot be planted immediately after being cut from the tree, they should be heeled in the ground and kept moist and shaded so as to prevent drying out.

"In planting the cuttings two buds only should be left above the ground; this will generally mean that 3 inches of the cutting is above ground and 9 inches below. The ground in which they are planted should be well worked, and if it is soft it will be sufficient to dig a trench 1 foot deep and 1 foot wide, but where the ground is hard a trench 3 feet deep and 2 feet wide should be made. The soil round the cuttings must be pressed down firmly with the foot after planting and then be well watered.

"In order to successfully raise trees from cuttings they must be constantly watered during the dry weather in early summer, and on no account must they be allowed to dry out. From this it will be seen that it is useless to attempt to make a hedge with cuttings unless water is available, and it would be preferable to strike the cuttings in beds where water is available and transplant them the following winter.

"*Methods of Planting.*—The mulberry trees can be grown as a hedge or as single trees. For purposes of silkworm rearing in other countries, great attention is paid to the proper growth of the trees and they are treated very much like fruit trees, being planted 15 feet to 25 feet apart and pruned with great care. Pruning is done with the object of getting a low-growing, well-formed tree, so that the leaves may be gathered by women and children from the ground. In pruning, the same principles are used as for fruit trees.

"In this country mulberry trees are being largely planted as hedges; these will serve the double purpose of providing shelter and leaves for silkworm feeding. In planting hedges the cuttings or trees should be spaced 3 feet apart in single or double rows according to the amount of water available. If the soil is dry a single row would be best, but where irrigation is possible they could be planted in two rows with the trees alternating.

"The white mulberry is a very rapid grower, and cuttings planted in July or August will yield a fair quantity of leaves the following February or March, but if it can be avoided it is not advisable to strip leaves from trees under one year old.

"In many countries the trees are allowed to grow for five years before being stripped, and they are given a rest for one year after every period of five years.

"It is very important when stripping the leaves not to denude the tree entirely, but to leave a few leaves at the end of each branch. Another important point to be observed is that the leaves should be nipped off singly with the thumb nail or be stripped upwards from the branch so as to prevent the bark being injured as would often be the case if they were stripped downwards from the top of the branch.

"The quality of the silk produced is greatly influenced by the quality of the leaves used in feeding the silkworms, so that every care should be taken to produce good leaves.

"The leaves should never be picked when they are wet, as they are then liable to seriously affect the silkworms; and they should be crushed as little as possible. With this object in view it is advisable to gather the leaves into a bag hung on the branch of the tree and fastened with a hoop at its mouth to keep it open.

"The white mulberry (*Morus alba*) is considered the best species for silk production. It is a drought-resisting tree and thrives well in the Transvaal, more especially in the warmer localities. In cold parts of the high veld it is apt to be cut back by late frosts in spring, which often retards its growth and even kills the smaller branches."

The most suitable ground for the growth of the mulberry is a high and fairly level piece of land to which the wind has free access. It is not advisable to plant it on low lying or too well protected land, as it has been found in other countries that such ground merely serves as a breeding place for all manner of disease which first attaches itself to the leaf and thus finds its way into the body of the worm.

Plucking the Leaves.—The plucking of leaves ought to be done in the morning after the dew has evaporated, but in general practice one frequently plucks to suit his convenience. Leaves may be stored in a room set apart for the purpose, and for two or three

days retain their moisture. Neither sun nor wind should have access to the store-room, and water may be sprinkled over the leaves to enable them to retain their moisture, as the leaves must in no case be given in a withered condition; on the other hand, too much sap in the leaves will be harmful to the worms. In order to prevent fermentation of the leaves they should be spread out for an hour or so before being fed to the worms.

The age of the leaf should be relative to that of the worm, as it has been found by practical experience that young worms which are fed on old leaves, or old worms fed on young leaves, are very liable to succumb to various diseases, and although such may not die they will scarcely moult, or will spin indifferently.

The Rearing of the Silkworm.

Rearing Rooms.—One of the most important features to be considered in connection with the rearing of silkworms is provision of a suitable building, as success primarily depends upon the accommodation which is provided. Our experience in the Transvaal goes to prove the fact that a brick building with a thatched roof is undoubtedly the best for this purpose, more especially on the high veld, where the nights during the summer months are frequently cold. An iron building is considered to be most unsuitable, as it becomes very warm during the day and too cold at night; consequently it is extremely difficult to conveniently regulate its temperature. An open fireplace or hot-water pipes would be the best means of heating such a building, but such methods would be too expensive for the ordinary person who intends to commence this industry in the Transvaal, and, therefore, they cannot be generally recommended. If, however, the temperature of the rearing room should happen to fall below 68° Fahrenheit, an ordinary paraffin stove could be used to raise the temperature. (See Plate 103.)

The silkworm is not a tropical insect, and attains its best development between the temperatures of 68° and 77° Fahrenheit. Sericulturists should, therefore, remember that the temperature of a rearing room should not fall below nor exceed the abovementioned limits, as if such should occur it would undoubtedly prove detrimental to the worms and, consequently, seriously affect the quantity and quality of their spinnings.

The rearing room should also be dry, free from draughts, with a supply of fresh air, and protected from direct sunlight. It should also be evenly lighted, so that the progress of all the worms may be similar, because if kept in the dark they eat little and their growth is retarded.

Implements Required for Rearing Worms.—It is a notable fact that the initial expenditure required for commencing silkworm culture is smaller than for almost any other industry, and this factor should act as a stimulus to the encouragement of sericulture. The profit which would be derived from the sale of cocoons during the first year would more than remunerate one for the initial cost. The following is a list of the articles which are considered indispensable for starting this industry:—

1. Several light movable stands upon which shelves should be placed. These shelves should be at least 3½ feet wide, and a space of fully 18 inches left between each shelf. In order to prevent

unnecessary expenditure to those who cannot afford to purchase wooden shelves, strong reeds could be utilized for this purpose. In order to ensure proper ventilation these stands should be placed in the centre of the rearing room, and if it should be found that ants are troublesome the ends of the stand should be placed in shallow tins containing a small quantity of paraffin which could be renewed at intervals. The most effective and cleanest method, however, for preventing ants from crawling up the stands and annoying the worms is to tie a small quantity of cotton-wool around the legs of the stand half-way between the floor and the first row of shelves. (See Plate 104.)

2. A few sheets of brown paper, or blotting paper, for placing over the wooden shelves or reeds.

3. A small ladder for reaching the higher shelves, which could be manufactured on the premises.

4. A large knife for cutting the leaves and a basket for distributing them to the worms.

5. A thermometer for registering the temperature.

6. Trays for holding the worms. For young worms which have newly hatched from the eggs the most serviceable and inexpensive tray to use is mosquito netting stretched over light wooden frames, 24 inches long by 18 inches wide. After the worms have attained a larger growth, fine wire netting, ⅝ inch, should be used. Fine cord netting, which is manufactured locally, could also be employed for making trays. It is not desirable to use a smaller size of tray than the one described above, as it would not only mean an unnecessary amount of labour in the manufacture, but would also involve a greater amount of trouble in handling the worms. (See Plate 104.)

7. A supply of sulphur for disinfecting the rearing room; some dry bush which is odourless and free from gum, to construct spinning places for the worms.

8. It has been found on several occasions in the Transvaal that bats, fowls, cats, mice, and rats have proved very troublesome in destroying silkworms, and in such cases it would be advisable to keep a small supply of wire netting on hand so as to be able to protect the worms if they are attacked.

Disinfection.—Cleanliness is absolutely necessary in connection with sericulture, and this point cannot be too strongly emphasised. Before starting the rearing of silkworms all the shelves and implements should be thoroughly cleansed with a solution of sulphate of copper in the proportions of 1 part of sulphate of copper to 100 parts (by weight) of water, i.e. 1 pound of sulphate of copper to 10 gallons of water. This should be done about a fortnight before the introduction of the worms.

When all the appliances are ready the doors and windows should be tightly closed, and the rearing room fumigated with sulphur (about 11 pounds to every 100 cubic yards of space). In order to have the room properly fumigated, the following directions should be carefully observed. The sulphur should be powdered and placed in an earthen vessel over a slow fire. When the sulphur melts and catches fire of itself the vessel should be immediately placed in the rearing room, with the windows and doors completely shut for fully twenty-four hours.

After fumigation, the walls of the room should be thoroughly whitewashed with lime, and the floor with a solution of sulphate of copper. The fumes of sulphur kill germs of disease which may have escaped the action of the sulphate of copper.

Ventilation.—Another important consideration in the successful rearing of silkworms is ventilation, as the worms should be surrounded continually by pure air. In order to ensure a proper system of ventilation, double openings should be made in the windows which would permit the heated bad air to pass out above and the cool fresh air to enter below.

Silkworm Eggs—How to Hatch them.

Upon receipt of the silkworm eggs they should be washed in a solution of sulphate of copper in the proportion of 1 part to 100 parts of water (by weight), and immediately afterwards placed in a shady place to dry. Great care must be exercised in this process, because when eggs are washed in this solution it is absolutely necessary to get them dry as quickly as possible. The eggs must not be exposed to the direct rays of the sun. Shortly before the eggs hatch they assume a whitish colour. The best method to adopt is to place double pieces of mosquito netting lightly over the eggs, upon which finely cut mulberry leaves have been placed, the idea being to prevent the unhatched eggs which become attached to the netting from being removed with the new-born worms to the trays. If such worms hatched at a later date, the natural consequence would be that worms of different sizes would be mixed up on the same tray, which should be carefully avoided.

Life-History of the Silkworm.

The mulberry-feeding moth (*Bombyx mori*), which is one of the principal moths used for the production of silk, belongs to the Bombycidae, a family of Lepidoptera, in which are embraced several of the largest and most handsome moths. The *Bombyx mori* is a conspicuous ashy-white moth, and, through the result of hundreds of years of domestication, is incapable of flight. The male is about half an inch in length, and the female is a little longer and stouter, its wings being short and weak. After copulation, which occupies about six hours, the male soon dies. The female almost immediately afterwards commences to deposit her eggs, and continues doing so until she has laid about 400. After oviposition has taken place the female dies. (Plate 104.)

As is common with all insects of its class before reaching the winged stage, *Bombyx mori* exists (1) as an egg, (2) as a caterpillar or larva, and (3) as a chrysalis. (See Plate 105.)

The Egg.—The egg of the common silkworm is about the size of a mustard seed, being yellowish at first, but in a few days it assumes a darker colour. As the *Bombyx mori* is single brooded, i.e. produces one generation in a year, its eggs must be hibernated in a cool chamber, preferably in a cold-storage room, for about six months at a temperature of from 25° to 40° Fahrenheit in order to ensure a uniform hatching.

The First Age.—After the eggs have hatched, which usually occurs in the morning, they should be placed on the mosquito netting on the shelves which have been previously prepared to receive them.

It is most essential that each tray should be marked with the date of the birth of the worms, and each day's hatchings should be kept entirely separate.

If it should happen that a hatching occurred at a temperature of from 68° to 70° Fahrenheit, this temperature should be maintained during the first age, and the worms should be fed at least eight times during the twenty-four hours. If, however, the temperature at the birth of the worms happened to be from 75° to 77° Fahrenheit, it should be slightly diminished one or two degrees, and the worms should be fed ten times during the twenty-four hours. It must be distinctly understood that the appetite of the worms increases or diminishes with the temperature of the rearing room. When feeding during the first age, only young and tender leaves without stems should be used, and these should be cut up very fine and sprinkled over the worms. The leaves should also be distributed uniformly over the trays so as to prevent the worms from crowding together and in order to enable them to make their changes simultaneously. A greater quantity of leaves than is required at one feeding should not be cut, as they become withered very quickly and consequently lose their nutriment. The leaves should not be kept in water, but preferably in a basket, over which a damp cloth should be placed to enable them to retain their moisture.

During the feeding of the worms the doors and windows should be left open for the purpose of enabling them to be supplied with a good supply of fresh air. After feeding, however, these should be closed, unless the day is warm, when they might be permanently left open or might be protected by curtains through which a current of air passes freely.

Another important factor to be remembered in connection with silkworm culture is the daily cleansing of the trays and shelves, because the bed upon which leaves and excrement are allowed to accumulate contitutes a very great source of danger to the healthy condition of the worms. The most convenient method of procedure to adopt is the following:—The last meal at night should be placed on the mosquito netting and extended over the worms. By the morning the worms will have mounted to this tray in search of fresh food. Then these trays should be lifted up, beginning at the top shelf, and placed on clean shelves. The worms which may have commenced moulting in the under trays should be handled with great care, which can be safely accomplished by means of a soft brush or feather. This cleaning should preferably be done in a separate room or under a well-protected verandah, and when finished the litter should be removed some distance from the rearing room, because if allowed to become dry the dust which arose from it might be carried in the air to the rearing room and cause disease to the worms. It will be found that this litter makes an excellent manure.

Towards the sixth day it will be observed that the worms begin to eat less, which is a sure sign that they are preparing to undergo their first moult. The moulting of the worm can be easily distinguished on account of the fact that the head swells, the skin becomes white, and the body transparent, and it remains practically

motionless for a short time. It then becomes necessary to double the space required for the worms.

The worms which have not moulted will have crawled up to the fresh leaves, whilst those which have remained below will have already begun to moult. The backward ones should therefore be kept entirely separate and put in a warmer place, preferably on a higher shelf, and given several extra feeds. The feeding of the worms should be gradually diminished, and whenever the backward ones begin to moult should be ceased entirley as soon as a single worm comes out of the moult. A fast of twenty-four hours will not hurt the advanced worms, while the extra feeding given to the backward ones will practically enable them to become equal to those which have already moulted.

The Second Age.—The coming out of the sleep can be easily recognised by the worms moving their heads, which are now whitish, whilst the rest of their body is greyish in colour. As worms take several hours to regain their strength, no food should be given to them until all have moulted. Four days after coming out of the first moult the worms begin to moult again. Then the same method of procedure should be undertaken as before described, that is, place the backward worms on separate trays and give them extra feeding until they have become equal with those which have already moulted. After each moult the space allotted to the worms should be doubled, as crowded worms become sickly and diseased.

The Third Age.—After the worms have moulted a second time they cease to be grey and assume a whitish colour. The third age is undoubtedly the most critical period of their existence, and one in which they seem to suffer the most; consequently precautionary measures should be adopted to prevent the temperature from falling below 68° Fahrenheit. As in the two former ages, the worms should be lightly fed after coming out of this moult until they have regained their strength, and as they have doubled in size during this age the space alloted to them should be accordingly increased; they can also be fed upon whole leaves.

Towards the sixth or seventh day of this age the worms begin to be languid and lose their appetite, and are consequently ready to commence another change.

The Fourth Age.—During this age small branches of leaf may be given to the worms instead of whole leaves as in the former age, and the number of meals may be reduced to four per day. If the temperature is kept at from 68° to 70° Fahrenheit the period of this age will last about nine days. If, however, it is desired to reduce this age to seven days the temperature should be raised to 72° Fahrenheit.

The Fifth Age.—During the fifth and last age the worms have a voracious appetite which is difficult to satisfy. At the end of about five days the body of the worm suddenly diminishes in circumference, and its excrement, which was formerly dry and firm, now becomes soft and moist, and its appetite capricious. The worm generally remains in this state for about three or four days, when it suddenly ceases to feed and endeavours to get away from its food.

It should be noted that at the end of the fourth moult bundles of dried bush, which is entirely free from gum, should be placed between the shelves in rows fully 15 inches apart, the branches being of sufficient length to form an arch in which the worms will crawl up to spin their cocoons. Straw may also be conveniently used for this purpose. As soon as they have found a suitable place they evacuate their digestive canal and begin to throw around them an irregular net in which the cocoon which will be spun later will be suspended. Sufficient space should be given them to prevent them from being too crowded, for if two worms spin together they form a double cocoon, which reduces its value, as the silk cannot be unwound.

The caterpillar then becomes transformed to the chrysalis, which transformation takes from seven to ten days from the time at which the first worm began to spin. The cocoons then become mature, and this is the best time to gather them. The thread of a cocoon is continuous with that of the web and varies in length from 1,200 yards to 1,600 yards. (See Plate 103.)

Preparation of Cocoons for the Market.

After the cocoons have been gathered the chrysalids should be killed by means of heat or suffocation. The methods most popularly employed are (1) the heat of the sun, (2) hot dry air in a stove, (3) hot humid air in a stove, (4) steam, (5) carbon bisulphide or some other gas.

From the results of experiments which have been conducted in the Transvaal we find that the cleanest, cheapest, and most effective method of destroying the chrysalids is to put the cocoons on large iron trays in thin layers and then place them in the sun for several days. The trays containing the cocoons should, of course, be brought inside the rearing room during night and protected from rats and mice.

We cannot recommend the use of carbon bisulphide, as this method is not only expensive, but far too dangerous for the ordinary sericulturist to undertake. Carbon bisulphide is a liquid which volatilizes readily at ordinary temperatures, the gas is poisonous, is in confinement inflammable and explosive, and it is therefore necessary that the greatest precautions should be adopted that no light, such as a lighted cigar, pipe, or match, comes in contact with it.

The cocoons should afterwards be carefully sorted into three classes: (1) The perfect cocoon, (2) the double cocoon, and (3) the defective or spoiled cocoon.

If the cocoons are not intended to be marketed immediately after the chrysalids have been killed and thoroughly dried, they should be packed in boxes, care being taken that they are not crushed during this operation.

Rules to be Observed in the Rearing of Silkworms.

For sericulturists who intend rearing an ounce of silkworms, it may be stated that an ounce contains approximately 40,000 eggs, and if ordinary precautions are adopted in the rearing it may be assumed that 30,000 eggs will hatch.

Ages of Worms.	Approximate quantity of Mulberry Leaves required for feeding worms which hatch from an ounce of eggs.	Space required in Trays.	Temperature to be maintained in the rearing room.
First age ...	About 10 lbs.... ...	10 square feet ...	68 degs. to 70 degs. Fahrenheit.
Second age ...	About 30 lbs.... ...	30 square feet ...	70 degs. Fahrenheit.
Third age ...	About 110 lbs.... ...	90 square feet ...	70 degs. Fahrenheit.
Fourth age ...	About 340 lbs.... ...	270 square feet ...	72 degs. Fahrenheit.
Fifth age ...	About 1,900 lbs. ...	810 square feet	76 degs. Fahrenheit.
TOTALS	About 2,480 lbs ...	1,210 square feet.	

DISEASES OF SILKWORMS.

The principal diseases against which the sericulturist has to guard are:—

1. *Pebrine.*—This disease is caused by a transparent egg-shaped microbe about three-thousandths of a millimetre in size, which is found in the egg of the silkworm and is present in the body of the worm on hatching. It attacks the worm, chrysalis, and moth at all stages; as a rule, the worm does not die, but produces a bad cocoon. This disease was first observed in France in 1845. It has afterwards been observed in Italy, Spain, Portugal, Turkey, China, and Japan. It may be stated that between the years 1833 and 1865 the annual crop of cocoons in France was reduced by this disease from 57,200,000 pounds to 8,800,000 pounds

The remedy for preventing the dissemination of this disease is to have all moths which are used for breeding purposes microscopically examined, and only eggs laid by healthy moths retained for rearing worms. Black spots are the outward characteristics of this disease.

2. *Flacherie,* or indigestion, generally attacks worms after their fourth moult, and without any apparent cause they begin to languish and shortly afterwards die. The principal causes which contribute to the dissemination of this disease are (1) eggs being spoiled through careless preservation; (2) careless feeding; (3) wet, sweating, and fermented leaves being fed to the worms; (4) lack of a proper system of ventilation; (5) excessive heat; (6) dust; and (7) keeping the worms too crowded on the trays. In general the greatest care and cleanliness should be observed in order to prevent the worms from contracting this disease.

3. *Gattine.*—This disease generally attacks the worms in the first ages, more especially after moulting. The disease generally manifests itself in indifference to food, torpor, dysentery, and emaciation. Worms which contract this disease do not generally die before mounting to the bush for the purpose of spinning their cocoons. Immediately this disease is observed the following precautions should

be adopted: (1) The beds should be changed, and the worms placed on disinfected shelves; (2) the suspected diseased worms should be burned.

4. *Muscardine.*—In this disease the worm becomes whitish and hard, shows a disinclination to eat, and then dies. It is due to a micro-organism which is thought to enter the body by way of the leaves. Great care must be taken in destroying worms affected by it, as the disease is most infectious. The chief cause of this disease is neglecting to change the beds and keeping litter in and around the room. Should the worms contract this disease the floor of the rearing room should be washed with a solution of copper sulphate and the room afterwards fumigated with sulphur in the manner previously described.

5. *Grasscrie.*—In this disease the body swells visibly and the segments protrude. The worm becomes whitish in colour and lustrous; it cannot sleep, but wanders restlessly about. This soon wearies it, its body swells and eventually bursts, emitting a white pus. On account of its infectious tendencies, worms affected by it should at once be destroyed.

Review of Work done in Transvaal.

Sericulture was commenced in the Transvaal by the late Mr. C. B. Simpson during the summer of 1906. He imported an ounce of the European variety of silkworm eggs (*Bombyx mori*) for the purpose of conducting experiments as to whether this industry could be established with success. After his death these experiments were carried on each year.

During the past summer (1908-09) we carried on the largest and most important experiment hitherto conducted, and it is gratifying to have to state that it was very successful. Hundreds of people have visited our laboratory, and have received information regarding sericulture, and have been shown the methods to be adopted in the unwinding of the silk from the cocoons, although the machine which we used was of a very primitive nature. The interest in this industry has increased to such an extent that we have received numerous enquiries during the past few months as to whether the Department intends to supply silkworm eggs free of charge, and also what arrangements are to be made regarding the purchase of cocoons raised in the Transvaal.

We have already proven by experiments that the European variety of silkworm can be successfully reared on the high veld of the Transvaal from October to the end of March, but in the low veld we have found that the temperature during the summer months is too high for rearing silkworms; however, such rearing can be successfully done from April to the end of September. Several municipalities have promised to plant mulberry trees in the vacant plots in their towns in order to enable the poorer people to commence this industry in a small way. Arrangements are also being made to obtain a variety of mulberry and castor-oil eating silkworm from Ceylon for the purpose of discovering which is the most suitable variety for the low veld of the Transvaal. In a year or two, when there is a sufficient supply of mulberry trees growing, this industry could be prosecuted more vigorously than at present.

An experiment was also conducted at the Swiss Mission Station, at Shiluvane, Zoutpansberg District, during the months of August and September last year, for the purpose of demonstrating to the farmers in that neighbourhood the feasibility of establishing sericulture as an industry in Zoutpansberg. Although the experiment was a great success, the number of farmers who visited Shiluvane was very disappointing.

In order to encourage the industry we informed intending sericulturists before the commencement of last summer that we would be prepared to purchase the cocoons raised by them at 3s. 6d. per pound, and up to the present date about fourty pounds have been purchased.

One great drawback at present is the fact that if the cocoons are sent to Europe their bulk is so great, and they would take up so much space, that the cost of transportation would be excessive. The most economical and practical method to adopt would be to have the silk unwound in the Transvaal at some central place, preferably Pretoria, and then forwarded to the factories in Europe as raw silk, as is done in India and China. This work can only be economically done by proper machinery. In France one girl can attend to several of these machines, whereas our experience has been that if the unwinding is done by hand a person can only unwind about 22 grammes of silk in five hours. Such silk can be sold at the rate of about 15s. per pound. When we take into consideration the cost of the rearing of the worms, it will be readily understood that this method of unwinding is not one which can be recommended. It has been estimated that a woman or girl on a farm where there are plenty of mulberry trees can rear as many as four lots of worms during the summer and thereby make a handsome profit during the season.

The following prices have been offered in France for Transvaal cocoons:—

Cocoons of best quality ...	14.5	francs per kilo.
Double cocoons	5.0	,, ,,
Pierced cocoons	8.55	,, ,,

We have found considerable difficulty in the importation of eggs from Europe. If we obtained eggs of the season in which our order was sent in, the eggs would arrive at Pretoria too young, and, consequently, when we endeavoured to hatch them out they hatched very unevenly and continuously for the space of a month or more. The eggs should be at least ten months old, in which case all the worms will emerge in the space of four or five days, thus shortening the time necessary to feed them. The rearing of our own eggs cannot be recommended unless we have a trained bacteriologist to supervise the work.

It should be distinctly understood that sericulture in the Transvaal is at present only in the experimental stage, and whilst we are endeavouring to foster it in every possible manner, several years may elapse before it is placed on a sound commercial basis. In other countries it has been found that artificial stimulation has never resulted in success, more especially where an abundant supply of cheap labour was not available.

Any further information which may be required by people who intend to commence silkworm culture will be gladly supplied upon application to the Government Entomologist, Pretoria.

II. INSPECTION OF ORCHARDS IN THE TRANSVAAL.

By D. Gunn, Acting Government Entomologist.

For the information of fruit growers it may be stated that legislation recently enacted provides that all places where fruit trees are grown should be inspected.

The desirability of the systematic inspection of orchards in the Transvaal has been recognised for a considerable time; and as the work of inspection is to begin at a comparatively early date—very probably before this article can appear—it is considered advisable to state briefly the benefits which will be derived from such work.

The systematic inspection of nurseries in the Transvaal was first undertaken about four years ago, and by means of such inspection we were able to discover the presence of many insect pests which were more or less prevalent at that time, but by judicious work and the loyal co-operation of the nurserymen such pests are now held in check, and thereby prevented from being disseminated to various parts of the Colony, as frequently occurred previous to the commencement of this work.

Such nurseries are inspected once and occasionally twice each year, and if found to be in a clean condition a certificate is granted to that effect. Further, if any nurseryman in the Transvaal is desirous of despatching his nursery stock to the other South African Colonies, an application is made upon his behalf to the Government Entomologist, or other responsible official of those Colonies, and an intercolonial nursery permit is granted to him for this purpose.

The systematic inspection of nurseries has not only materially assisted the various nurserymen, but, as already stated, has prevented the dissemination of many dangerous insect pests in the Transvaal, and it has now been considered necessary to inaugurate the same system of inspection in connection with orchards.

Through the assistance rendered by several of the field cornets, we have been able to compile a list of the names of fruit growers in the Transvaal, but as this list is at present far from complete, it is earnestly requested that the fruit growers themselves assist us by sending their names to this office, and in this manner enable us to inspect their orchards at an early date.

In order to allay the fears of many fruit growers, it may be stated that this work is to be undertaken for the sole purpose of giving them advice, and enabling them to eradicate many dangerous insect pests which may be prevalent in their orchards, and thereby assist to lay the foundation of a prosperous fruit-growing industry in the Transvaal.

The depredations caused by many insects appear to be increasing, as can be certified by the thousands of letters which we are receiving each year requesting information regarding their extermination, and it is therefore considered necessary to commence this work of inspection as early as possible.

Large quantities of fruit from oversea, and also from neighbouring Colonies, are inspected daily at Johannesburg, Pretoria, etc., and, if found to be infested with a certain percentage of insect pests or plant diseases, are rejected, and afterwards either reconsigned within a certain time to those places from whence they were originally

despatched, or are destroyed by fire. Whilst we are anxious to protect the interests of our own fruit growers as much as possible, it is not considered judicious to permit large quantities of diseased fruit which is locally grown being placed on our own markets. Fruit growers in the Transvaal are therefore earnestly requested not to despatch fruit from their orchards, which is infested with insect pests, and to write to the Government Entomologist, Pretoria, for information regarding the eradication of such pests.

III. SOME INSECT PESTS OF LAST SEASON.

By F. Thomsen, Division of Entomology.

The enormous rains which fell in the Transvaal during the last six months have brought to notice many insect pests which, in a drier season, would not have been so serious. On the other hand, parasites preying on these pests have also increased in numbers, and the moist atmosphere was favourable to bacterial diseases in some of the stages of insect life.

Many reports of serious loss and damage have been received by this Division. All these communications were promptly dealt with, and it is pleasing to be able to state the advice given, when followed out, often prevented further loss.

The Lucerne Caterpillar (*Colias electra*).

This yellow butterfly was noticed in most of the lucerne fields, laying eggs, and the caterpillars which hatched out of these did most serious damage, especially on very young plants; they were even troublesome as late as March, a most unusual condition.

On small plots a spraying with a solution of 1 lb. arsenate of lead to 25 or 30 gallons of water destroys the caterpillars. This spray should only be used when the lucerne is very young or has just been cut, as the poisonous solution might cling too long to the plants, and when reaped in this stage cause loss of the animals fed upon it.

In larger fields rolling or bush-harrowing can be recommended when the lucerne is still young. Larger plants should be cut as soon as the caterpillars are noticed, the cut lucerne removed, and the lands then rolled or bush-harrowed.

Army Worm or Pigweed Caterpillar (*Caradrina exigua*).

This is the caterpillar of a night-flying moth, and is reported from many town lands and private farms; Nylstroom, Barberton, and Klerksdorp were the most affected. This pest can easily be kept in check if it is attacked in the earlier stages; a spray with 1 lb. arsenite of soad and 1 lb. sugar to 16 gallons of water, soon destroys the caterpillar. Stock should be kept away from the sprayed area for some time, or till good rains have fallen, and under no circumstance should the solution be made stronger than the above dose.

On growing crops 1 lb. arsenate of lead to 30 gallons can be used. This solution does not harm plant-life.

Termites.

The various kinds of termites, or white ants, were very busy after the heavy rains.

The large termite (the forage ant) did a great deal of damage on oats, barley, etc. Good results were obtained by the use of the Universal Ant Destroyer. The nozzle, which is inserted into the hole in the ground, should be elongated by means of pieces of tin so as to bring it to a fine opening; very small holes can then be treated. Brown packing paper has been used for that purpose, but this is often damaged by the heat and moisture.

The best time to destroy the forage ants is when they are working energetically, which will be found to be the case on cloudy afternoons before a change of weather; the working channels are then open, and the arsenical fumes can be pumped deep into the nest.

Poisoned bait has also been used with fairly good results. This is made as follows:—3 lbs. of bran, chaff, or cut forage is moistened with a solution of ½ lb. of brown sugar or treacle and one desert-spoonful of arsenite of soda and water. This mixture is spread round the working hole of the forage ant. Animals must be kept away. It must, however, be remembered that the poisoned bait will only kill the individual insect which eats it; the young larvae and the queen often escape, as they are not fed directly with the poisoned bait.

The termites attacking buildings or trees should also be treated with the arsenical fumes pumped into their nests or holes by means of the Universal Ant Destroyer.

Trees under irrigation are rarely attacked by termites. On dry lands the trees should not be watered round the stem, but the water should be poured into a hole some distance away from the trunk of the tree. Place some pieces of dry wood, such as pine, etc., near this water-hole. A careful watch should be kept, and any new hole made by termites under this wood should be treated at once with the ant destroyer. Poisoned bait cannot be recommended for these termites, as only a few individual insects will be killed.

The Natal Orange Moth (*Enarmonia batrachopa*).

Many complaints were received recently that the orange crops were damaged by an insect. Small spots are noticed on the fruit, which become larger, and often allow the free entrance of a fungous disease in warm and moist climates. The fruit drops off, or if picked it is useless for the market, for when opened a small fleshy-coloured caterpillar will be found inside.

The life-history of this insect is not fully known as yet. It appears, however, that the eggs are laid as soon as the fruit begins to swell. The first caterpillars were noticed in December, and at the end of May also quite young caterpillars were found.

All infected fruit should be destroyed at once so as to prevent the caterpillar from pupating, which is done, as a rule, in the ground under the dropped fruit. The easiest way is to dig large holes between the rows of orange trees and have all infected fruit picked each day and placed in the holes. These holes ought to be covered with at least 12 inches of soil once a week. In this way it will be found possible to keep the moth in check.

The Castor Oil Caterpillar (*Ophiusa catella*).

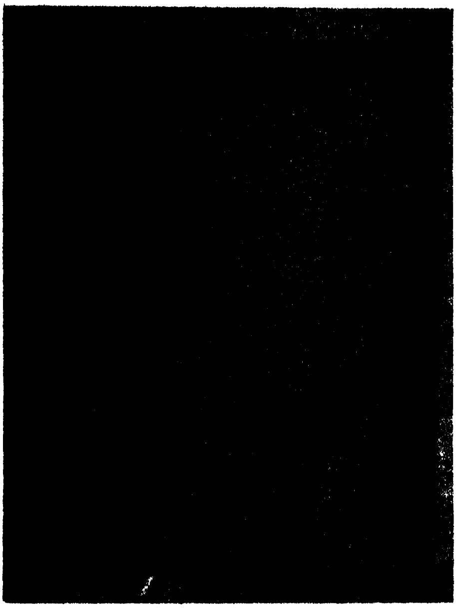
This is the caterpillar of a large, greyish moth, which also does a great deal of damage on ripe fruit, especially peaches and grapes.

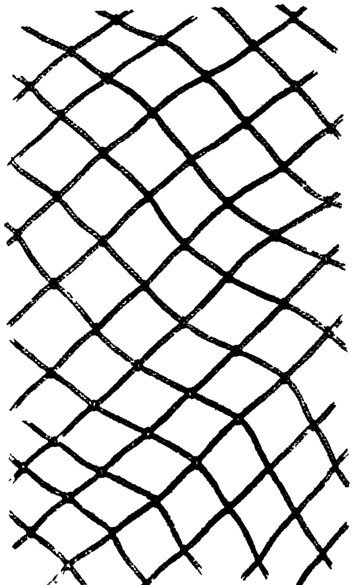
Fig. 1.
Model Rearing Room.
(From Bulletin No. 39, U. S. A. Department of Agriculture.)

Plate 103.

Fig. 2.
Cocoons Raised in Pretoria.

Silk-worm Culture.





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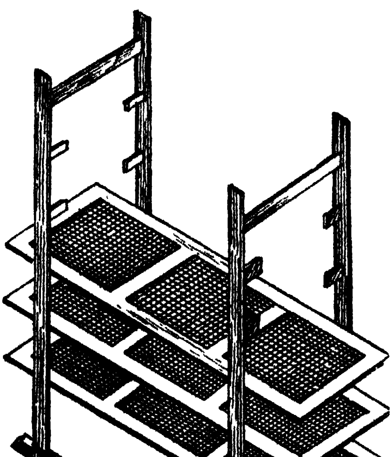

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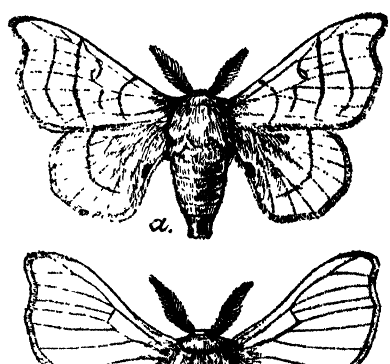


b. 4

Plate 104 **Silk-Worm Culture.**

1. Tray with Wire Netting. 2. Net for Changing Beds.
3. Light Movable Shelves. 4. The Moth: *a* the Male; *b* the Female.

(Figures 3 and 4 taken from U.S.A. Department of Agriculture Bulletin No. 39.)

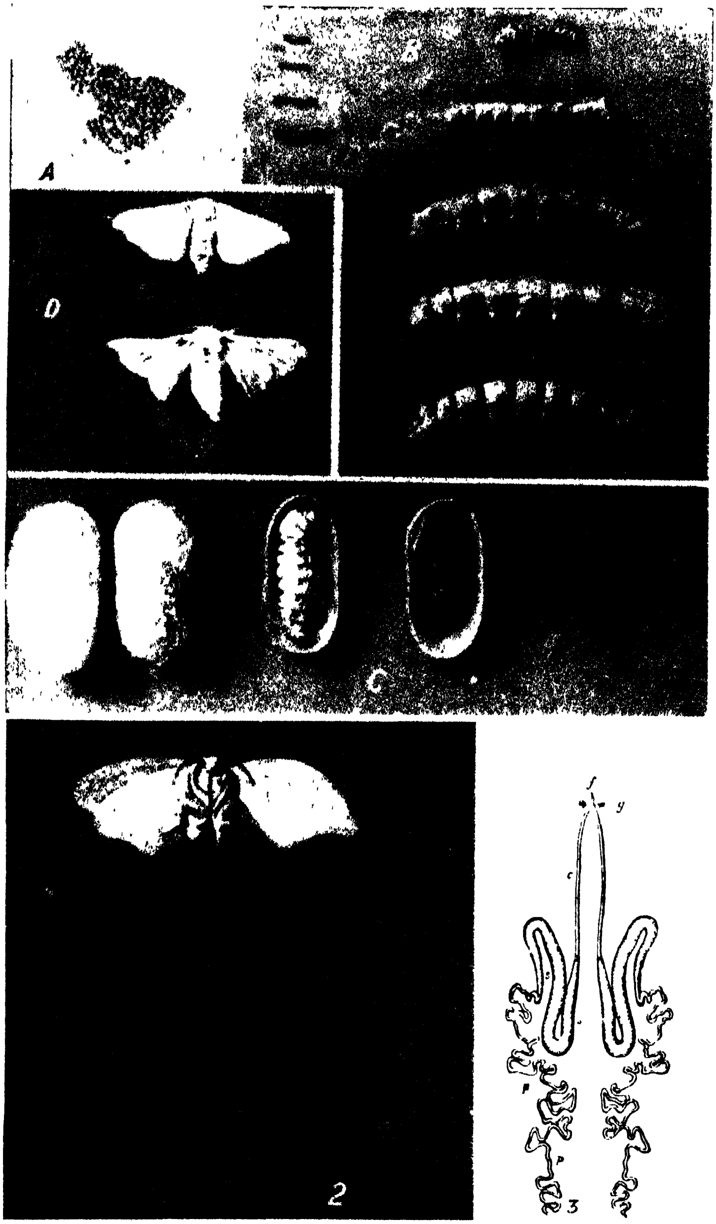


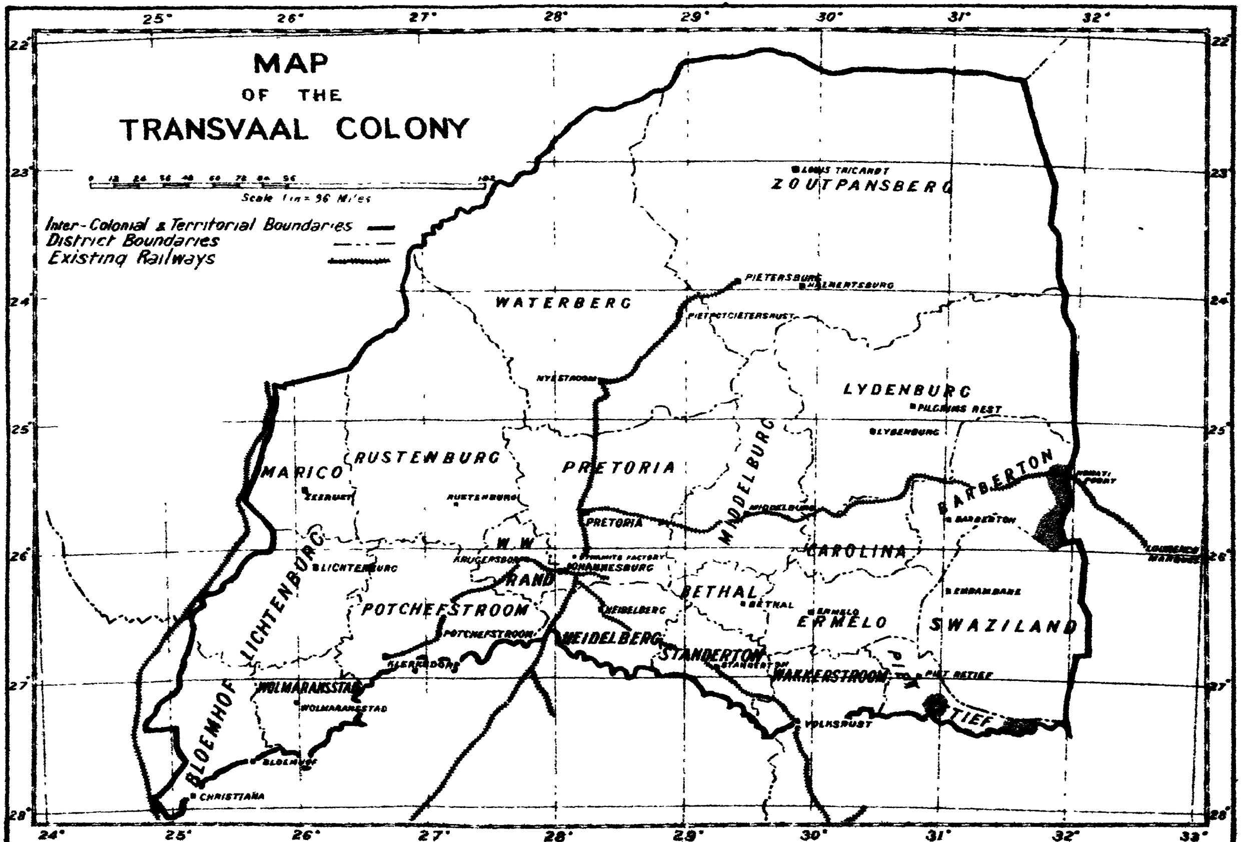
Plate 105. **Silk-Worm Culture.**

(1) *a* Eggs, *b* various stages of worm, or caterpillar, *c* various stages of pupation; *d* moths.

(2) Eggs of moth.

(3) Silk glands in a mature worm: *p* portion of glands which secrete the silky matter; *s* reservoir; *c* conducting canal; *f* spinneret; *g* accessory glands.

(From Bulletin No. 39, U.S.A. Department of Agriculture.)



LOCUST CAMPAIGN.

● Voetgangers of the Redwing Locusts—Season 1908-09.

The eggs are laid on castor oil plants, on the upper side of the leaves, and are small grey objects about the size of a pinhead. Three years ago whole castor oil plantations were destroyed, and the caterpillars appeared again this season in large numbers, though for the last two years no serious damage had been done. This pest is only noticed by farmers, as a rule, when it is really too late to fight it successfully. When the eggs are noticed on the leaves a careful lookout should be kept for the young caterpillars, and a spray with 1 lb. arsenate of lead to 25 or 30 gallons of water should be applied at once. If the field is too large, a dry dusting with 1 lb. paris green, 5 lbs. lime, and 5 lbs. flour, well mixed and placed in a muslin bag, will be found useful. After a heavy rain this should be repeated.

The Large Cricket [*Brachytrypos membranaceus* (Fabr.)]

In sandy soil in the warmer parts of the Transvaal these crickets are often met with; they do considerable damage to all kinds of plants.

A poisoned bait, made as follows: 3 lbs. bran, green grass, or lucerne, ½ lb. sugar or treacle, 1 desertspoonful arsenite of soda or paris green, will be found useful. It has been tried in many places with the best results.

Carbon bisulphide can also be used; about a tablespoonful should be poured into the holes, and the holes covered with soil. This chemical is, however, very expensive, costing 10s. a gallon at Pretoria, and as it is also highly inflammable and poisonous its use cannot be recommended.

Cutworms.

Cutworms or mestworms are the caterpillars of a moth. They can be found in the ground round the stem of cabbages, tobacco, lucerne, mealies, and many other economic plants. The damage done is often very considerable.

The best remedy is a poisoned bait prepared as follows:—3 lbs. of bran, ½ lb. sugar or treacle, 1 desertspoonful of arsenite of soda or paris green, and enough water to make a fairly moist paste. Place this bait round the stem of the infected plants, or sow it broadcast in infected lucerne fields. Domestic animals should be kept away.

Mealie Stalk Borer (*Sesamia fusca*).

Many mealie crops have suffered this season from the attacks of this caterpillar. The moth lays its eggs on the young mealie or kaffir corn plant, and when the caterpillar hatches out it will soon bore into the stalk of the plant.

To keep this pest in check all mealie and kaffir corn stalks should be removed from the field with the roots and destroyed, or run through a cutting machine and fed to stock. Deep and thorough cultivation is of the greatest importance. A trap crop can also be recommended. This is a small lot of mealies sown as early as possible alongside the mealie field before the main crop is planted. As soon as the caterpillars are noticed the whole of this catch crop should be removed and buried, fed to stock, or burned.

Eelworm (*Heterodera radicicola*).

This microscopically minute nematode worm should by rights not be classed under insect pests. This Division, however, has

made extensive experiments in connection with the damages done by this worm on various economic plants; it is therefore felt that mention of it should not be omitted in this article.

The seriousness of the damage will be understood if it is pointed out that ground infested by this worm cannot be used again (for some time) for crops like potatoes, tomatoes, tobacco, swedes, turnips, etc.; many flowering plants and fruit trees also are attacked. The worm is carried from field to field by means of irrigation water or by heavy rains. No sure remedy is known at present. Moist weather appears to be favourable to the growth of the eelworms. In dry seasons the food-plants cannot grow so well, and the worm will disappear. It is, however, known that the eelworms can stand drought and heat. It has also been proved to be able to pass through the stomach of an animal and to be distributed with the manure.

Infected land should be planted with mealies, wheat, oats, or barley. The abovementioned food-plants should be sown only on new soil.

IV. THE REDWING LOCUST CAMPAIGN, SEASON 1908-09.

By F. Thomsen, Assistant Chief Locust Officer.

Although many flying swarms of redwing locusts were reported during the months of November and December, 1908, in Waterberg, Zoutpansberg, Lydenburg, Barberton, and Piet Retief Districts, eggs were laid only over a small area in Barberton and Piet Retief Districts during December, 1908.

In January, 1909, the voetgangers made their appearance, and locust officers were immediately appointed. As stated above, the infested area being small it was not considered necessary to appoint more than one assistant locust officer for the Barberton District, and one district locust officer and one assistant locust officer for the Piet Retief District.

It is pleasing to state that no loss of stock through arsenical poisoning was reported from Barberton or Piet Retief Districts.

Barberton District.

In this district voetgangers hatched out in the neighbourhood of Komati River, along the Crocodile River to the west, and the Komati River to the south near the Swaziland border: 123 swarms of voetgangers were killed by the locust officer. The native population did not help much, as the maroela season interfered; reports, however, were received that huge swarms of European storks (*Ciconia alba*) and some blue jays (*Coracias caudatus* and *C. Mocambicus*) helped to minimize the swarms of voetgangers. Considering the heavy rains, and the consequent malarial fever, the work done in this district was very good. No swarms of flyers escaped, and no crops were destroyed.

Piet Retief District.

In the beginning of January, 1909, reports were received that voetgangers had hatched in the eastern part of this district. The country there is very broken, is rather narrow, is situated between Swaziland and Natal, and is difficult of access. Continuous rains and

swollen rivers caused great delay in the work of destruction against the voetgangers, and the locust officers and natives suffered from malarial fever. The sweetened arsenite of soda spray was often washed off the long grass by the rain, and had to be repeated; in fact the herbage was mostly so wet from dew and rain that the destruction of voetgangers by grass burning was impossible. Great help was given to the locust officers by farmers and natives; fifty swarms of voetgangers were killed by officers, and five swarms by farmers and natives. In this case the swarms were very large, the smaller swarms not being accounted for. It was reported that huge numbers of locust birds, mostly the European stork (*Ciconia alba*) helped in the destruction work, more than 100 swarms being killed that way. The damage done to growing crops by voetgangers was small—about £20 was mentioned. No swarms flew away, and no further damage was done to crops.

260 lbs. of arsenite of soda, 150 lbs. of treacle, and 7 pockets of sugar were used in the two districts during the redwing locust campaign.

No swarms of redwing flying locusts have been reported in the Transvaal during the last three months.

Poultry Section.

I. POULTRY FOR THE FARM.

By Mrs. J. Cheere Emmett.

So much has been written by experts and fanciers about poultry-keeping that I am rather diffident about giving my experience, but as it may be of assistance to farmers' wives who, like myself, have to learn by experience, I hope the experts and fanciers will not smile at my primitive methods. The keeping of poultry has always been a great hobby of mine, not only for profit, but pleasure as well.

Breeds.

My favourite breed is Buff Orpington, and it is wonderful how rapidly it has gained a world-wide reputation as a utility breed. The large size of the birds, and the ease with which they can be reared and kept should make them very attractive to farmers' wives who look to the egg basket and table. As egg producers I know of no other fowl that will outclass them if carefully bred for egg laying. Their egg-laying qualities are derived from the Hamburgs, size from Buff Cochin, meat from the Dorking. They are essentially the fowl for the farm, and having tried several varieties I have given them up for this breed.

Hatching.

Personally, I prefer the incubator as being safer and more economical, as the hen, after she gets over her broodiness goes on laying while the incubator does the hatching, and if properly managed the chickens are really very little trouble. For successful incubation it is absolutely necessary to observe the following points:—

(1) Incubator must be kept in a quiet, well-ventilated room with an earthen or stone floor, perfectly level.

(2) Eggs must be fresh and clean; if possible not more than six days old.

(3) Machine must be carefully watched and instructions from makers strictly carried out.

(4) After each hatching, machine must be thoroughly cleaned and disinfected.

(5) Attend to the lamp every evening.

Rearing of Incubator Chicks.

As all poultry appliances are so very expensive I rear my chicks in home-made foster mothers, which are Nestlé's milk boxes lined with old flannel, and with a clean sheepskin nailed over the top to keep them warm. Here they remain for the first thirty hours

without food, and then if the weather is fine they are put out into the world in small portable runs made as follows:—

A frame 2 feet high is made of flooring boards 6 feet long and 3 feet wide, and covered with fine netting open underneath so that the chickens are put on to fresh ground every day. At night they are put back into their flannel-lined boxes, and if the weather is very cold placed near the stove, but do not use artificial heat if you can help it as it is apt to make the chickens weakly.

For the first ten or twelve days feed every two hours, diet consisting of baked mealie meal and crushed sunflower seed, minced shallots, and lettuce, and last, but not least, broken ant heap; the ants replace the insect life they would get if foraging about with their mothers. A little epsom salts mixed in their food once a week keeps them healthy.

When chicks are a month old they are put into larger runs in which their sleeping boxes are placed, and once or twice a week they are allowed out for a run. Keep grit in sardine tins in the runs; broken crockery of all descriptions smashed fine makes an excellent grit.

Should vermin make their appearance dip the chickens in a weak solution of Leaver's Extract of Tobacco and warm water, choosing a bright day; clean and disinfect boxes and runs by spraying.

The best months for hatching I find are June, July, and August. The chickens are more or less immune from chicken-pox, and come on to lay when eggs are scarce and dear in February, March, and April. This is, I know, contrary to the opinion of many who claim that there is not sufficient insect life during the winter months, but that can always be given by feeding ants where ant heaps are procurable, and, where they are not, sheep's liver, cooked and minced, is an excellent substitute.

Care of Poultry.

An ounce of prevention is worth a ton ot cure. Keep poultry clean and healthy, and you will have very little trouble. I have not had fowl sickness amongst mine for years, and can only attribute their immunity from that terrible scourge of poultry yards to regular dipping. Once a month I have a bath filled with warm water into which is put sufficient tobacco extract to make a fairly strong solution. The birds are caught one by one in the house and dipped into the bath. Early morning is the best time as the birds have the day to dry in; the weather must be warm and bright. Any of the non-poisonous dips will answer the purpose, but I find Leaver's Extract of Tobacco the best.

After dipping, spray the roosts and houses. The fowl-house must be swept every morning—the manure is excellent for the vegetable garden—it is best kept in a barrel or old bath.

About every three months I give the fowls a mixture of castor oil and Little's Dip. Mix twelve tablespoonfuls of castor oil with one tablespoonful of Little's Dip, and give each fowl a teaspoonful of the mixture. The leaves of bitter aloes given in small pieces tend to keep the birds healthy.

Feeding.

The best rule for feeding is common sense. The health and usefulness of fowls do not depend on following rules so much as on getting sufficient palatable food and grit. Plenty of green food is an absolute necessity, and that, with oats and crushed mealies, form their staple food. In cold and wet weather I mix coarse mealie meal with the liquor that salt beef or mutton has been boiled in, add vegetables such as cabbage, carrots, beets, potato peelings, or shallot minced. Add salt and crushed ginger, mix thoroughly, and bake in the stove for a couple of hours. The result is worth the extra trouble and the fowls relish a warm meal before going to roost.

Moulting.

During the moult, egg production is very much reduced, and, owing to that there is very often a diminished interest taken in the poultry on the farm, and they are left to themselves, and yet at no time do fowls require more care and attention. I find that feeding well at moulting helps them through. The production of new feathers requires the consumption of the right kind of food, viz., sunflower seed, scraps of meat or ants, buckwheat and maize—the latter boiled. Heavy feeding during moulting can be given without danger of the fowls becoming too fat.

Scaley Leg.

This is an unsightly disease, and unless attended to is a cause of much discomfort to the birds. Wash the legs thoroughly with hot water and carbolic soap; when dry apply with a brush (an old tooth brush answers the purpose) extract of tobacco mixed with a little castor oil—the mixture must be well brushed in.

The foregoing is a somewhat rough sketch of how farm poultry can be economically and profitably worked, and I hope may be of some assistance to sister poultry-keepers.

The Dry-Land Farming Section.

I. DRY-LAND FARMING IN COLORADO.

By Mr. E. R. PARSONS, in "Pacific Rural Press."

(Paper read at the Dry-Farming Congress, Cheyenne, Wyo.)

I COMMENCED operations with 160 acres. With the help of cows, pigs, bees, and chickens our income amounted to about $3 per day. I now have about 1,200 acres, and make my money out of steers, lucerne, corn, and fruit. My formula has been: "First get your moisture, then raise a crop on it." Figure out that every year will be a dry year with the minimum of precipitation. In my part of Colorado the minimum during the growing season in 30 years has been 2 to 2½ inches. To meet this without fear of failure we need at planting time at least three feet of moisture. The most profitable way of operating is naturally to raise crops as often and continuously as possible, which necessitates obtaining the greatest amount of moisture in the smallest amount of time. This can best be done by deep ploughing, followed by fallowing.

When corn has been harvested after an average season, if the ploughing and cultivation have been good, there is usually some moisture left over, probably one or two feet of soil about 10 per cent. wet. Then by disking and cultivating as soon as possible and keeping the land open all winter and spring, we can usually secure at least three feet of moisture by planting time, and if this three feet contains about 12 to 15 per cent. water, a fine crop can be raised with the minimum rainfall of 2 to 2½ inches during the growing season.

The moisture in a sub-soil usually runs well after a wet winter like the present, but should it fall as low as from 6 to 8 per cent. in the upper three feet, it had better be allowed to lie fallow for an entire season.

Where the precipitation is less than in this vicinity (Parker, Colo., near Denver) it may be necessary to fallow every other year.

I dwell at length on the questions of moisture to show that by eliminating all elements of chance we can make of this dry farming almost an exact science. If you can secure three feet of moist soil by planting-time and this soil contains 12 to 15 per cent. water, the roots of your crops will go into it, and you thereby bring into action three feet of soil. This is the secret of thirty and forty bushel crops, instead of fifteen or twenty bushels.

The practical depth for the small farmer to plough is ten or twelve inches, or as deep as he can go with one team of three or four horses without keeping an extra team and man for subsoiling. My experience with sod is that if you plough it three or four inches, Kansas and Nebraska fashion, it dries out and does not rot, and sowing anything on it is like trying to raise a crop on a rag carpet. We disk our sod land when it is wet in summer or fall, getting down about three inches, then plough five inches deeper, then disk again and harrow until the ground is as fine as old land before planting.

My lucerne costs me in actual work about 75 to 90 cents a ton in the stack. It costs the irrigator in labour and water $1.90 to $2. The same is true with all crops.

To make an exact science of the orchard branch of dry farming, you take no risks whatever by getting your moisture before planting your trees, and then by bottling in the subsoil more than the trees can use, you render your orchard absolutely drought-proof.

I started by planting a small family orchard in 1886-87. By intense cultivation I secured about three to four feet of moisture from the surface down, before planting a tree. We soon had all the small fruits we wanted, and apples began to appear on the trees. By cultivation the moisture kept gaining, and in 1895 this little orchard contained twelve feet of moisture from the surface down. This orchard was planted on what was originally dry buffalo-grass prairie, not in a draw, but on a flat hillside, and on the grass land alongside the orchard there was no moisture showing at any depth. In 1895 I planted a commercial orchard of 2,000 trees, with the same results. The fifth year the cherries and plums had paid for the orchard to date, and since then, with two bad years, I have sold from $3,500 to $4,000 worth of cherries, plums, and apples.

There is an immense field for this business in the plains region, and people will come for miles to get cherries. Sour-cherries are the best drought-resisting and hardiest trees I know of, and will stand almost anything except seepage, over-irrigation, and flood water. Up to date, by careful cultivation, I have accumulated nearly twenty feet of moisture in the soil from the surface down. On the prairie adjoining there is no moisture at any depth.

The snows of winter may be conserved by a simple device of throwing up back furrows at right angles to the general direction of the wind. By this device you can have your orchard covered with snowdrifts when the adjoining prairie is bare and your orchard gets the benefit of the moisture when the snow melts.

The Veterinary Section.

DISEASES, TICKS, AND THEIR ERADICATION.*

BY DR. ARNOLD THEILER, C.M.G., Government Veterinary Bacteriologist.

THE more we begin to understand the diseases of stock contracted in the veld of South Africa, the more we realise that ticks play an important role in their propagation. It is, therefore, advisable to review our present knowledge concerning these diseases, as well as the life history of the tick, and to deduce from this how the eradication of the ticks—and with them many diseases—is possible.

There are three different kinds of organisms which make use of the tick as a host for the propagation of the disease, namely, piroplasms, spirochaetes, and ultra-visible organisms.

THE PIROPLASMS.

There is one piroplasm known in equines of South Africa, the cause of biliary fever. It affects horses, mules, and donkeys, but it varies in symptoms in the different animals.

When we say it affects equines, we must make a reservation in stating that the South African animal—the animal born and bred on the veld—when it is grown up is not so liable to suffer from the disease and escapes notice; it only does so under special conditions. This fact finds its explanation in the observation that young equines (foals) do not readily die of the disease, although they contract it as soon as they are exposed to infection on the veld. The chief sufferer, however, is the animal which is bred in the stable of a town or which is imported from oversea; for instance, from England or America, where this disease is unknown. We must remember, therefore, in speaking of piroplasmosis of the equine, that the animal born on the veld of South Africa is immune against this disease. The parasite which causes the piroplasmosis or biliary fever, *Piroplasma equi*, lives within the red corpuscles of the blood, where it multiplies, and then invades a smaller or greater number of other corpuscles. Its action is the destruction of the red corpuscles, and the more of these parasites that are present, or the quicker they multiply, the more dangerous becomes the disease. The destruction of the corpuscles becomes apparent by the anaemia which follows. In the horse, however, this anaemia is hidden, so to say, by a bilious condition. The destruction of the red corpuscles leads to the separation of the colouring matter from the corpuscles, which is deposited in the liver, and there undergoes a change into bile stain. An over-production of bile takes place, which is carried into the blood-stream, and absorption

* NOTE.—This paper is written with the object of showing the practical deductions to be obtained from a careful study of the cause of diseases, and their propagation by ticks, and also of encouraging farmers to forward ticks collected from the smaller animals, mammals, birds, and reptiles, in order to find out the number of hosts the various ticks may have.

Particulars as to the method of forwarding ticks and any other information will gladly be furnished by the Government Veterinary Bacteriologist, P.O. Box 593, Pretoria.

into the tissue follows. Hence we recognise biliary fever in the horse principally by the yellow discoloration of the mucous membranes. It is very rarely that the destruction of the red corpuscles leads to colouring of the blood plasma and subsequent red urine. In the mule and in the donkey the jaundice is not pronounced, and the white membranes indicating anaemia are typical of the disease.

The curious and remarkable fact has been established that an animal, say a horse, which has recovered from this disease retains the infection in its blood.

We cannot see the organism microscopically in the blood corpuscles of such an animal. The corpuscles have an absolutely normal aspect and the animal to all appearances is healthy, but when we inject the blood into a susceptible imported horse, mule, or donkey, we promptly produce the disease, which can end fatally and be of such a virulent character that it differs in no way from that contracted naturally. This fact has been made use of to prove that the various piroplasms of the horse and the donkey, and of the bastard, are identical.

In our experiments we have proved that the blood of an animal which has recovered, and which for eighteen months has been kept in a stable, still proved to be infective; and it can be concluded that once an animal has recovered, its blood remains infective for the remainder of its life, at least if such an animal remains exposed in the veld.

This disease is carried by ticks—the ticks are the real hosts of the piroplasm.

We have proved this experimentally. From observations it had to be concluded that only two species of ticks could be made responsible as the hosts, namely, the ordinary blue tick (*) and the red tick (†).

The former had to be excluded, and the latter proved to be the host. We have produced the disease with ticks which had been feeding on sick animals and on animals which had recovered. The incubation time of the disease, when contracted from ticks, averages about three weeks.

Redwater in Cattle.

The South African redwater is identical with the Texas fever of America, and the studies which have been made on that continent on Texas fever have proved to apply to our disease in South Africa. It is due to the presence of *Piroplasma bigeminum*, a parasite similar to that of the horse, which invades the red corpuscles, multiplies and increases, and causes the destruction of the red corpuscles. Whereas in biliary fever of the horse discoloured urine, due to the breaking down of the red corpuscles, but rarely occurs, it is almost an invariable symptom in redwater of cattle. This fact is probably explained by a greater delinquency of the blood corpuscles of cattle.

As regards susceptibility, the conditions are similar to those referred to above under biliary fever in horses.

The animals bred in stables and imported from areas free of redwater contract the disease easily and die in great numbers. The calf is susceptible, but it contracts the disease in such a mild form that it recovers easily, and then it is immune for all time, or only under special conditions are breakdowns of immunity noticed.

* *Rhipicephalus decoloratus.* † *Rhipicephalus evertsi.*

Redwater is a tick-transmitted disease. American investigators were the first to prove this in a convincing way, and we in South Africa have repeated the experiment time after time on imported stock and with ticks sent to Paris and London. It is the blue tick which carries the disease, although lately our experiments have shown that not only this tick can act as host of *Piroplasma bigeminum*, but also the brown (*) and the red ticks. These two form the exception rather than the rule, whereas with the blue ticks practically every one can transmit the infection.

We have stated that the animal born and bred in South Africa is immune, and what we have said about immunity in biliary fever of the horse applies to redwater in cattle. The immune animal retains the infection in its blood. We can prove this at any time by tapping an animal born on the veld and injecting a susceptible imported one; we have done so in many experiments, and lately an experiment of ours has shown that an animal which recovered in 1902 from redwater still had virulent blood in 1909. American investigators have even proved that the blood of a cow which had recovered from Texas fever, and had remained for twelve years out of the infected area, still produced the disease. The incubation period of this disease, when naturally contracted by ticks, is about seventeen or eighteen days.

Gall-Sickness.

It is with some diffidence that I make use of the term gall-sickness, knowing from experience that under this name many maladies of cattle are included, of which we do not exactly know the cause in every instance. One form of gall-sickness is due to dry veld, and another to vegetable poisoning, but I have been able to trace one disease due to the presence of piroplasms. The disease is not a very fatal one; the animals do not show acute lesions as in redwater, but on microscopical examination we frequently come across this piroplasm. Several times in the diagnosis of East Coast fever it has caused us some difficulty, since it resembles the piroplasm of East Coast fever so much that at a certain stage it is difficult to differentiate between the two. Our experience is that the majority of cattle born on the African veld are infected with this piroplasm, and in our experiments—undertaken to elucidate the role of this parasite—we have frequently observed that the blood of an ox, picked up at random and injected into a susceptible animal, not only causes the appearance of redwater, but after recovery from it the second piroplasm appears. I have called this parasite *Piroplasma mutans*.

What is known of the two former diseases applies to this also. Calves born on the South African veld do not suffer from it, or not much. It is the imported animal, and in this animal the disease takes a chronic course.

It is accompanied by fever and the symptoms of anaemia, which are diagnosed by the paleness of the mucous membrane. In no instance have we seen red urine accompanying this fever. It is tick-transmitted, and although we have not such a large number of experiments at our disposal as we have in the former two diseases, yet we have been able to transmit this disease by the red tick and by the brown tick. The incubation time may vary from three to four weeks. It

* *Rhipicephalus appendiculatus.*

must also be borne in mind that the immune animal retains the infection in its blood as in the other diseases already mentioned.

Gall-sickness is also called the sequel of redwater. When an animal has contracted redwater, and the destruction of the red corpuscles by the presence of *Piroplasma bigeminum* is not such an acute one that the separation of the colouring matter takes place rapidly, causing red urine, different symptoms may appear, namely, those of jaundice. The picture presented by the disease completely resembles that of biliary fever in the horse, namely, the yellow discoloration and anaemia of all mucous membranes, and the blood shows typical lesions of anaemia, which permits of the diagnosis of the disease. The anaemia is sometimes so pronounced that death results, and when the liver is examined it will be found to be quite yellow and the gall-bladder to contain a thick greenish mass of bile, which discolours the whole surroundings.

I have already stated that if we inject the blood of an animal born on the South African veld into an imported one we may observe redwater, acute or chronic, as described, or we may observe a *Piroplasma mutans* infection, which I classify under gall-sickness. In addition to this we very frequently meet with a disease which I have not yet been able to explain with sufficient accuracy; I am convinced that it represents a disease of its own, though I have not sufficient evidence for an absolute proof.

When an animal has recovered from redwater brought on by injection of blood, it may show a second attack of a disease, sometimes of a very acute nature, with all the symptoms of gall-sickness as described under Sequel of Redwater, namely, high fever, paleness, and yellow discoloration of the visible mucous membranes, loss of appetite, rumination, and rapid loss of condition. Red urine is never observed. This form of the disease has hitherto been connected with redwater. The presence of certain bodies within the red corpuscles, appearing on their margin, are typical; they take the characteristic protozoa staining distinctly, thus proving their protozoic nature. It is not decided yet whether these bodies really belong to *Piroplasma bigeminum* or whether they represent a parasite of their own. Personally I hold the latter view. This disease in which they are found is rightly called gall-sickness, showing all the symptoms of bile infiltration of the tissues. On post-mortem the yellow discoloration of the whole body is marked, the liver is enlarged and yellow, and the gall-gladder contains a thick green bile, as described before. I wish to emphasise that this disease is also carried by ticks, and our experiments point to the fact that the blue tick can act as carrier, which forms another difficulty in separating it from redwater itself. I wish also to emphasise again that, similar to the disease mentioned before, the immune animal retains the infection in the blood.

Spirochaetoses.

Spirochaetes are blood parasites in the shape of small curves looking like a corkscrew swimming in between the red corpuscles of the blood. They have been found in horses, cattle, and sheep of South Africa. Their injection into a susceptible animal gives rise to a high fever, which, however, in my experience, has never ended fatally, yet symptoms which point to the destruction of the red corpuscles are present, and are easily recognised microscopically. We

have transmitted the parasite artificially by inoculation. The fact interests us that not only the animal which is suffering from such a fever, but also the recovered animal, retains the infection in its blood, and such blood proves infective at any time.

The disease is transmitted by the blue tick. We have proved this undoubtedly in several instances, and it has been verified by Laveran in Paris, to whom we sent the ticks, which promptly produced the disease in Paris. This disease does not play an important role as the cause of death, but may be occasionally responsible for fever and loss of condition in any of the mentioned animals. We have met with it occasionally in smears sent to us from cattle supposed to be suffering from gall-sickness.

East Coast Fever.

This formidable disease has, during the last eight years, played considerable havoc, and is still prevalent in South Africa. It is due to a parasite resembling the group of piroplasms which invades the red corpuscles, and multiplies there to such enormous numbers that finally almost every corpuscle contains one or more of them. Unlike the other piroplasms which we have described, it does not cause the destruction of the red corpuscles, or, if so, only to a slight degree, and the cause of death of an animal is not due to an acute anaemia as in other diseases, but due to intoxication by the metabolic products of the parasite. It differs from the before-mentioned piroplasms in other ways, and the principal one is that it is not inoculable by blood or any other material from a sick animal into a susceptible one. All experiments which we have undertaken during the last eight years with material from sick animals have failed.

It further differs from the other piroplasms by the fact that the immune animal does not retain the infection in its blood. We have observed this in practice, and experiments which we have made with ticks have failed in every instance. Further, it is different by the presence of peculiar bodies in the internal organs of sick animals, which probably represent a developing stage in the life cycle of the parasite, and which give us a diagnostic medium of recognising it from *Piroplasma mutans* infection, of which I have said that it sometimes causes difficulty in diagnosing. So it becomes evident that the parasite of East Coast fever is not a proper piroplasm at all, as it has been described previously, and it is for this reason that a new genus has been made by Bettencourt, to which he has given the name of *Theileria*.

This disease is transmitted by ticks, namely, the red tick, the brown tick, the shiny brown tick, the Cape tick, and the black-pitted tick, as Mr. Lounsbury and I have proved in many experiments.

The important fact to be borne in mind in connection with this disease is that recovered animals do not act as reservoirs of the virus.

The incubation period in this disease, when transmitted by ticks, varies from ten to twenty days, and averages about thirteen days.

Disease due to Ultra-Visible Micro-Organisms.

Heartwater in Cattle, Sheep, and Goats.

This is a disease in which we do not find any visible organisms. We prove their existence by the inoculability of the blood of a sick animal into a susceptible animal which promptly produces the disease. The action of the parasite is an intoxication of the body, as a result of which the animal may die.

The disease is tick-transmitted, as Lounsbury first proved; the experiments undertaken for this purpose have proved that the bont ticks play an active role in the propagation of it, but only when they have been sucking blood from an animal suffering from the disease, and not from an immune animal. The incubation period varies from five to fifteen days in goats, and about twenty to twenty-five days in cattle. It is of special interest to us that the immune animal does not act as a reservoir.

Reservoir of Virus.

The diseases which are tick-transmitted in South Africa may be classified into two groups. One, in which the immune animal retains the infection in the blood, in other words, in which the recovered animal acts as a constant reservoir for the virus: and the second group where the blood of a recovered animal becomes sterile and therefore harmless. The former fact explains the reason of the constant infection of African veld by redwater, biliary fever, and gall-sickness. The animal which recovers from the disease acts as a host for the ticks. The ticks become infected with the parasites and in turn carry them back again to the animal. In this way a circle is formed between the animal, the cause of the disease, and the tick. The tick and micro-organism of the disease are dependent on the animal; without the animal their life cycle would finish. They require the animals for the multiplication of the species, and accidentally, through the invasion of a great number of parasites, such an animal becomes sick and may die.

An adaptation between the animal and the micro-organisms results, by which both benefit, the animal with its immunity and the parasite with a permanent home. It can be deducted from these facts that the disease would have to disappear if we were able to break the circle by removing either micro-organism or tick, as the life cycle would naturally come to a standstill. It must be reasonably expected that the easiest thing to attack is the tick, but to attack it successfully its life history must be properly explained.

The Life History of the Tick.

The ticks belonging to the order of *Acarinae* are easily recognised by the naked eye as flat bodies when not engorged, or more or less swollen when engorged with blood. We distinguish male and female in the adults, the male always remains flat, whereas the female engorges and grows in size; in this country the latter is usually known as the tick proper. Male and female meet on an animal, and after feeding they seek each other for copulation, and as soon as the fertilisation has taken place the female engorges. Underneath this engorged female, the male can usually be found. Before repletion the female is about the same size as the male. The presence of the small tick underneath the female, especially in the case of the blue tick, has led to the popular opinion that this is a young one. After the female has repleted herself she hides in the grass or in the sand. Soon after hiding away in this manner she begins to lay her eggs. This process of oviposition varies in length of time according to the season in which the ticks drop. After a lapse of a certain period the eggs begin to hatch, and the young larvae appear; they are commonly known as seed ticks, and they seek their way to the top of the grass or bushes, from which they attach themselves to a suitable host which may be passing. So far the ticks with which we have to deal behave similarly, but the various species differ in their habits, and according to these habits we can divide them into three groups.

Firstly, the ticks which, for the completion of their life cycle, require only one host. To this group belongs the blue tick. It reaches the host as a larva; it moults (changes its skin) on the animal from the larval into the nymphal stage, and again from the nymphal stage to the adult stage. In the adult stage the sexes meet again, and the life cycle begins afresh.

Secondly, ticks which require two hosts for the completion of their life cycle. To this group belongs the red-legged tick. It comes as a larva, it moults into the nymphal stage, and leaves the animal as an engorged nympha. The moulting process takes place in the ground from the nymphal to the adult stage, and the sexes meet again on the host.

Thirdly, ticks which require three hosts for the completion of their life cycle. To this group belongs the family of the brown ticks, the black-pitted ticks, and the bont ticks. The larva reaches the animal and engorges, and, as soon as it has done so, drops to the ground, where it moults (after a lapse of a certain time) into the nymphal stage. The nymphae seek a second host, also engorge, and, after repletion, drop to moult into the adult on the ground. The sexes seek a third host, where they meet, and the whole life cycle begins again.

Of interest to us from our point of view are the dates required

(1) for laying the eggs;
(2) for the hatching into larvae;
(3) for the completion of the life cycle on the host in the case of the one-host animal—the blue tick;
(4) the time the larvae and nymphae require to replete on a host;
(5) the length of time the engorged larvae and nymphae on ground require to moult;
(6) the length of time the adult females remain on the host before they drop;
(7) the length of time these various ticks and stages of ticks may live.

Concerning these the following facts are known:—

Blue Tick.—The whole length of time this tick requires from larval to adult stage averages three weeks. From the third week the engorged blue females begin to drop, and about the end of the fourth week they have all left the host. In other words, when we remove an ox or a horse out of the veld and place it in a stable we must constantly expect during the four following weeks the appearance of blue ticks which have been picked up up to the day when the animal left the pasture. The female begins to lay her eggs about five days after she has left the host. This applies to the summer season only; in the winter it is postponed. The eggs hatch in the warmer season in about three to six weeks, and on an average after about thirty-six days; in the winter it will last a little longer. The young larvae kept in glass bottles have been known to live six months; if they do not reach the host they die: on reaching the host they continue the life cycle. During this time they sit on the grass; no food is obtained from the plant (as the popular belief is), therefore it follows that the blue tick must finally die, if after the above-stated lapse of time no host is found.

The Red-legged Tick.—The hatching period of the eggs of this tick is in summer about thirty days as an average. We have known the young larvae to live for a period of seven months. In the veld the young larvae which find a host generally hide themselves in the interior of the ear and in the flanks, and soon begin to replete. They undergo the change from larvae to nymphae on the host. The nymphae attach themselves near

the place where the larvae were, and replete themselves quickly, so that as early as ten days they may be replete and drop, but generally after an average period of fifteen days. The second moulting process takes place in the ground, and requires an average period of twenty-four days. In our experiments adult red-legged ticks have lived up to a year, and have after that time attached themselves to a beast; such longevity seems, however, to be the exception and the usual period is less.

The Brown Ticks.—Under this name I include the Cape brown tick* and the shiny brown tick,† whose life cycle is similar to that of the brown tick proper. In addition to these there are some more brown ticks which may act as carriers, but this has not yet been experimentally proved. The brown tick female, after it has been placed on a host, may be observed to drop already fully engorged on the fourth day, and by the end of a week it has usually left the host. The laying of eggs usually begins after six days. The hatching period averages in the warm season twenty-eight days; in the winter time the hatching takes several months. The young larvae readily attach themselves to cattle and engorge rapidly, and may drop off the host in as brief a time as three days; after the lapse of eight days all engorged larvae have dropped. The moulting process takes place in the ground, and averages twenty-one days. The shortest recorded period was sixteen days. The larvae have in our experiments lived up to a period of seven months and the nymphae to six and a half months. For some days after moulting, these creatures are not able to feed. They are colourless and weak, and refuse to bite if placed on animals. A few weeks later, however, they eagerly seek attachment when placed on the skin of a host. The nymphae also require a period of about three days to engorge, and within a week have dropped off the animal. The adult ticks appear out of these nymphae in summer time after an average period of eighteen days. They, like larvae and nymphae, are almost colourless and very weak. A few days later they take the characteristic colour, become more vigorous, but require some time before they will readily attach themselves to a host. In our experiments the adults have been known to live up to a period of nine and a half months.

The Black-pitted Tick‡.—The hatching period in this tick averages thirty days. The larvae do not attach themselves readily to cattle or horses, but to other animals, and the intermediate stages are found on smaller animals. The first moulting usually takes place after twenty days, and the second one, from nymphae to adult, after twenty-five days.

The Bont Tick§.—The female begins the laying of eggs in summer time about two weeks after dropping from the host, but over three months may sometimes pass. The shortest hatching period is about ten weeks, but it may last as many months—it averages from four to six months. In our experiments larvae have been known to live seven months. The young larvae replete themselves on a host in from four to twenty days, and the majority always drop between the fifth and seventh day. The first moulting takes place after twenty-five days, but sometimes four months may pass. The nymphae replete themselves on a new host in from four to twenty days. Nymphae have been known in our experiments to live six months. The last moulting process takes place after about twenty-five days, the shortest, and 160 days, the longest. The adult female drops from about the tenth to twentieth day after attaching. Adults have been known in our experiments to live up to a period of seven months.

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* *Rhipicephalus capensis.* † *Rhipicephalus nitens.* ‡ *Rhipicephalus simus.*
§ *Amblyomma hebraeum.*

*The bont-legged tick** has not been discussed here as it has not yet been proved to act as a carrier of the disease.

Transmission of the Disease.

From the life history, as outlined above, the following possibilities may be observed in the transmission of a disease.

Firstly, the transmission is effected by means of young larvae, whose mothers have been sucking blood from infected animals. This has been known to be the case in redwater and spirochaetosis; propagation of redwater by the blue tick is the principle modus; the larvae of the brown tick may transmit redwater, and the larvae of the red tick have proved to be hosts of spirochaetosis.

Secondly, the transmission is effected by one of the succeeding stages, either by the nympha which infected itself as a larva, or by an adult which infected itself as a nympha. The red tick has been proved to transmit biliary fever of horses, spirochaetosis, *Piroplasma mutans*, and *Piroplasma parvum* in the adult stage after it had been sucking blood of an immune or sick animal in the previous two stages. The group of brown ticks and the black-pitted tick transmit East Coast fever. It has been proved that the group of brown ticks and black-pitted ticks transmit the disease in their nymphal stage after they have been sucking blood from a sick animal in the larval stage. Further, the group of the brown ticks and the red-legged tick have been proved to transmit the disease in the adult stage after they have been feeding in the nymphal stage on a sick animal. The adult brown tick has also been proved to transmit *Piroplasma bigeminum* of redwater and *Piroplasma mutans*. The bont tick has been shown by Lounsbury to transmit heartwater in the nymphal stage, and in the adult stage after the larval and nymphal stages were fed on sick animals. It has further been proved that, contrary to the experience in East Coast fever, the brown tick can pass its nymphal stage on an animal not susceptible to heartwater without losing the infection it acquired in the larval stage, and transmit it in the adult stage to a susceptible animal. This is not the case in East Coast fever, where experience has shown that a tick after it has once bitten an animal can no longer transmit the disease. It must be emphasised here that the popular opinion that ticks pass from one animal to another and communicate the disease in this way is wrong. The destiny of females is to lay eggs, and of engorged larvae and nymphae to moult, and this makes it impossible for them to reach new hosts before they have reached the next stage; therefore, only *males* can pass from animal to animal and can transmit the disease in this way. Indeed, males of any species of ticks which we have mentioned can live for many months on a host, but their peculiarity is to remain on that host, which they only leave accidentally when they are rubbed off, and since experiments have proved that once they have bitten they become harmless, such an accidental change of host does not come into consideration in the propagation of the disease, at least in East Coast fever.

The Hosts of the Ticks.

From our point of view, it is all important to know which animal, in addition to those of which we have considered the diseases, may act as

* *Hyalomma aegyptium*.

hosts for the ticks, and the following notes have been recorded concerning this :—

The blue tick has been found on equines and cattle, sheep, goats, dogs, and antelopes.

The red tick has been found to occur on equines, cattle, sheep, and goats, the reed-buck, other antelopes, and the Cape hare.

The brown tick has been found on cattle, equines, sheep, and goats, dogs, on various antelopes, and the Cape hare.

The black-pitted tick has been found on cattle, horses, sheep, goats, dogs, on the wild dog, the jackal, bushpig, and the hedgehog.

The bont tick has been found on cattle, horses, sheep, and goats, dogs, the wild dog, on antelopes, and the ostrich.

The Prevalence of Ticks in the various Regions of the Country and in the Different Seasons.

Generally speaking the ticks are more frequent in the summer than in the winter time. This stands to reason, since a certain moisture and temperature is required for the process of hatching and moulting. The various species related are, however, not equally distributed throughout the various parts of the country. We may state that the higher the altitude and the barer the veld, the less frequent are there ticks, hence the bushveld is practically the home of the tick, and the name "bosluis," as given by the Dutch farmer, indicates this. The blue tick may be considered as the most cosmopolitan tick of South Africa and is found at all altitudes. Next to it is the red tick, which is met with in the high veld, but less frequently. The group of the brown ticks, especially the brown tick proper, is rarely met with on the plateau of the high veld, but it may be found there in protected valleys where the vegetation grows higher.

The same applies to the black-pitted tick. The bont tick is limited to the bushveld proper, and occurs only in places where the real bush is met with.

The Number of Ticks in proportion to the Number of Cattle.

Under the most favourable conditions the number of ticks increase directly to the number of hosts found on a farm, thus the more stock is kept the more the ticks will increase, and under such conditions the ticks may become so troublesome that, apart from their rôle as carriers of disease, they do enormous amount of damage by the withdrawal of blood from the stock and by the irritation they cause, which is generally known as "tick worry." Indeed, the ticks can kill an animal without even transmitting a disease. This we have seen in an experiment of ours, in which a horse was infested with blue ticks and which died as a result of this infestation, from acute anaemia, owing to the withdrawal of blood. Within three days 14 lbs. weight of blue ticks were collected which had droppen off this horse, and this amount only represented about half of the ticks which engorged themselves on it.

Influence of Cold.

We have stated that the presence of ticks is unequally distributed over high and low veld, and it may be expected that this fact finds its explanation through the temperature to which ticks are exposed in the high veld. Indeed, it is generally admitted that such is the case, and it may be so, for when such ticks as thrive best in the low veld are brought to the high veld by the removal of animals, the engorged females drop off, but do

not develop there. But the cold in itself is not a barrier in prohibiting the development of blue and red ticks in the high veld, as experience proves; the temperature of freezing point only retarded the moulting of the nympha into adults, but did not kill them; it did not affect the blue larvae at all; these latter only died when exposed for some time to a temperature considerably below freezing point.

Eradication of Ticks and Disease.

The facts quoted above indicate the ways and means by which we shall arrive at the eradication of ticks and with them diseases. From a practical point of view we shall consider the two points separately, the eradication of ticks and consequently the eradication of disease.

The eradication of ticks can be attempted in several ways:—

1. *Burning of Grass.*—Up to the present time the burning of grass has always been considered to be of great help for the destruction of ticks, and it stands to reason that such must be the case. Farmers have always distinguished burning of grass in season and out of season, to which they attribute, if not properly carried out, the cause of various diseases, such as redwater and gall-sickness. I believe that these observations have a certain foundation. But, nevertheless, the great importance attached to it as the cause of disease is generally exaggerated. Burning of grass undertaken at a time when most of the ticks have hatched and moulted and are sitting on the top of the grass must undoubtedly destroy them.

We note that the principal tick season is the summer, and with the cold, tick life is more or less at a standstill. The ticks which, up to the end of the summer, have moulted and are sitting on the top of the grass, will still fasten themselves on to a passing host, and they are responsible for the tick life which we notice during the winter months. During the cold weather the laying of eggs and hatching is prolonged; if therefore at the beginning of the cold weather burning is undertaken, we would only reach those ticks sitting on the grass and not those which sit underneath. These latter would, under the influence of the sun on the bare veld, probably hatch quicker, and when the young grass is shooting up, they will be found on the top of this grass. When, however, the burning of the grass is undertaken later in the season it would probably destroy the majority of the ticks, and the later the burning is undertaken the better the results would be. But grass burning alone, although carried out in the proper season, will not eradicate all the ticks, it only reduces their number.

Cattle which graze over the same veld maintain tick life, and ticks buried in the ground and not affected by the fire continue the cycle.

2. *Dipping.*—Dipping has been made use of, and is still being made use of as a very efficient means of destroying ticks, and undoubtedly it is so wherever it is carried out properly with an effective dip. For our deliberations we accept the condition that the ticks will always be killed when the dip reaches them, and therefore we do not enter into the details of the efficiency of any particular dip, but consider the question of dipping as a whole. In valuing the effect of dipping, we must take into consideration the life cycle of the species of tick with which we deal, and from this we can determine whether a method of dipping will enable us to destroy certain species of tick or not.

We have stated that the *blue tick* requires three to four weeks for the completion of its life cycle on an animal. It follows therefore that one dipping within that time, say every third week, is quite sufficient to destroy the crop of ticks collected during that time. The blue tick larvae

only live up to a certain number of months, hardly exceeding eight; within the eight months an animal would constantly pick up these ticks, and by dipping, these would be destroyed, and finally the period would arrive when an animal no longer picked up blue ticks; the young larvae which have not reached a host would have died in the meantime. Thus dipping for the blue tick should have almost a certain successful issue, always provided that no tick escapes the dip.

Referring to the *red tick*, we find that in its life cycle it seeks the host twice, once as a larva from which it moults into a nympha and remains there for about sixteen to twenty-one days before dropping; the second time as an adult, the female remaining on the host from six to ten days. It follows from this that a three-weekly dipping would not reach all the stages, and if it would be of any use for the destruction of the tick it would have to be repeated after at least every eighth day. Dipping continued in this way during the period the nymphae, larvae, and adults live in the grass, would finally lead to their eradication.

The Group of the Brown Ticks.—For the completion of their life cycle they seek the host three times; as larvae they replete in from three to five days. The same period is required as nymphae, and the adult female requires about a week before it drops engorged to the ground. If the dipping is to be of any use for the destruction of brown ticks, it would have to be repeated every fourth day at least, and be continued as long as the intermediate stages can live in the grass.

In the case of the *bont tick*, which also requires three different feedings on an animal, the case is much similar to that of the brown tick. The larvae remain on the animal from about four to five days, the nymphae about the same period, and the adult about a fortnight. The dipping to be effective, therefore, would have to be done at least about every four days.

From the above notes it may be seen that dipping as a *universal panacea* for the destruction of ticks must fail. It is impossible to dip any great number of animals every fourth day for a period of at least a year. *It will, however, be successful in the case of the eradication of the blue tick.*

3. *Starving the Ticks.*—The third method of eradication of ticks is the starving process, and this must undoubtedly lead to success in every case where we are able to keep the place, for a sufficient length of time, free of such animals as act as hosts. We note that the blue tick will only live about eight months, therefore keeping a pasture free of animals for this period must starve out the ticks. If it is our intention to rid a farm of red, brown, and bont ticks, this period must be extended to over a year. From observations made in connection with East Coast fever, where the freeing of an area from the disease is probably due to starving out of the ticks, it can be deducted that a safe period is fourteen months, and we can accept that this period will free any farm from tick life *under the conditions of no host having access to it.* If it is only the intention of freeing a farm of ticks, to a certain extent, that is to say, reducing the number of them and not eradicating them completely, the precautions need not necessarily be so strict.

Stock brought on to the tick-free piece of ground will naturally bring with them the ticks again, and they will increase in the usual manner, and after a few months they will be present in great numbers. But if it is our intention to get completely rid of the ticks, precautions must be taken not to bring ticks with the cattle into the clean veld. This can

be done by dipping or spraying the animals and immediately removing them on to the clean farm, but it can also be done without dipping and spraying. For this purpose the cattle should be placed on a smaller piece of tick-free ground, sufficiently large to carry them for about four weeks, and should be kept there for this period.

We will call this the quarantine paddock. During this time all blue ticks will have dropped off, and if it is only intended to escape these, the removal of the clean beasts into the final clean area can be done. It is possible than within the four weeks, the group of the brown ticks, engorged larvae, and nymphae, which dropped off during the first days of the removal into the quarantine paddock, may develop to a succeeding stage (nymphae or adult), in which they seek a new host, and then might be carried by the stock into the clean veld. It would therefore be advisable to transfer the quarantine after about three weeks to an adjoining clean piece, where the cattle would have to be kept another two or three weeks; there the remainder of the blue ticks would drop off, and no other new ticks could get on, and after this period the stock could safely be moved to a clean area. It is also possible that by the same procedure the bont tick would be got rid of, so that, theoretically speaking, it is within the range of possibility—without the use of dips or sprays—to get rid of all ticks. In practice this would have to be carried out by splitting the farms up into fenced paddocks, on which, after the stated period of about fourteen months, the movement of cattle could be commenced.

Eradication of Disease.

It is safe to conclude that the eradication of ticks means the eradication of disease. How this can be done has just been demonstrated. Under the conditions where the disease has broken out and no tick-free area is available, it cannot be made use of, and dipping, for the reasons given, would also fail. Here another method can be applied, namely, that of moving the stock out of the infected area into the non-infected one, arranging the movement so that the ticks which carry the infection and the animals which are infected remain behind. But this method can only be applied in those diseases where the immune animals do not act as a reservoir, such as in East Coast fever and heartwater.

East Coast Fever.—The principal carrier of this disease is the group of the brown tick, and occasionally the red tick, but from our point of view they have to be considered as equally harmful. Wherever possibility exists of the spread of East Coast fever, the following precautions should be taken: The cattle should be grazed on one particular piece of the farm and not indiscriminately all over; the piece should be fenced off and under no conditions should cattle be kept there. Should East Coast fever now break out, the following procedure should be adhered to. Collect all the cattle and bring them on one particular place of the clean ground which has sufficient grass to feed these animals for about three weeks to twenty-four days. In this camp the careful selection of sick and healthy animals takes place. The sick animals are killed or sent back to the infected ground, and the healthy animals remain.

In order to detect the sick animals early enough, recourse should be taken to the thermometer, and all animals with a high temperature should be considered infected and turned out of the camp. After twenty-two to twenty-three days, the remaining healthy animals can now be moved into the clean area; they leave ticks and infection behind. The reason for this latter movement will find its explanation in the following facts.

The average incubation period of East Coast fever is thirteen days, the longest (quite exceptional) twenty days. The average duration of the disease is twelve days, the longest twenty days (quite exceptional). Within twenty-two to twenty-three days it must therefore be possible, by means of the thermometer, to detect all infected animals. We have stated that the brown tick communicates the disease in either the nymphae or adult stage. For moulting it requires at least sixteen days, but an average period of twenty-four days. We have to reckon with the sixteen days, and we know that usually after the moulting another eight days elapse before such ticks are able to reach the top of the grass and to bite; of this fact advantage must be taken to remove the cattle out of the area before these ticks are ready to bite, and that is about twenty-three days after moulting. The period of moulting in the red tick nymphae is about twenty-four days, and here no danger would be expected. But even without thermometers, the moving of cattle is possible, namely, by making use of two quarantine camps, as explained before, leaving the animals in each camp for sixteen days. In thirty-two days all infected animals would have become visibly sick and could be excluded.

Heartwater.—If we want to trek out of a heartwater infected area, for the purpose of saving the stock not yet infected, two ways are open, depending upon what ground is available and whether such ground is infected with bont ticks. Moving out of the infected area into ground where no bont ticks are present means that the disease must stop.

This has been the experience of many bushveld farmers who, with their stock, went down to the low country, and when troubled with heartwater simply moved back again to higher-lying ground. The fact was known for a long time, but the explanation could not be given since no connection between tick and disease was surmised. If, however, no ground is available free from bont ticks, then the same procedure has to be resorted to as explained in the case of East Coast fever. Moving on to a place which is known to be free of heartwater, remaining there just over the incubation period of the disease, and moving out of it before the ticks which dropped have moulted, and are capable of attaching themselves, for which two quarantines of three to four weeks each will be sufficient.

ERADICATION OF DISEASES IN WHICH THE ANIMAL ACTS AS THE RESERVOIR OF THE VIRUS.

This applies to ordinary redwater, biliary fever in horses, and to the three forms of gall-sickness mentioned before. Should any of these diseases break out amongst a lot of cattle and we want to try and save the majority of them by removing them out of the tick-infected area, we can only stop the disease if we move into a tick-free area, leaving all ticks behind. Then the disease must stop. This is hardly possible under present conditions, and when we move the animals out of a tick-infected area into an area free of the disease but tick-infected, we only postpone the appearance of the disease, but will not completely escape it. As soon as the sick and the immune animals reach the new area they will infect the ticks on that area, and after the period of hatching or moulting, as indicated above, the disease will continue. The question arises whether it will be possible to breed stock free of biliary fever as regards horses, of redwater and gall-sickness as regards cattle; we must emphatically say that it is possible if we start with a farm where, by previous starvation, as indicated above, all ticks have been killed, and where all hosts of such

ticks are kept out by fencing. Farming with imported horses and cattle which have never suffered from biliary fever, redwater, or gall-sickness must be possible, provided that the farm is kept free of ticks, or even with the presence of ticks, provided that no such animals are on the farm which can act as a reservoir of the virus (immune horses and cattle). In other words, ticks may be allowed on such a farm if they have no chance of becoming infected. Naturally, such animals should never leave the place. They would contract the disease as soon as they were put into the veld where breeding of stock is not carried out under the same conditions. Breeding of stock free of infection from already infected stock can only be carried out under the conditions of absolutely excluding all tick life. It would have to be started by moving the stock through quarantine camps into an area previously cleaned of ticks, but in this case the ticks would, by all means, have to be kept out as long as the original lot of animals (the reservoirs) were present, because ticks introduced by any other kind of hosts would become infected with the disease of the immune animals, and in turn would communicate the disease to their progeny.

Thus, theoretically speaking, it would be possible to clean an area of ticks and to breed stock free of diseases out of imported and immune stock. The question now arises, would this be of any advantage at the present time? If one farmer carries out all the precautions and renders his farm absolutely free of ticks and thus breeds animals free of disease, it would mean that such animals have no immunity against the diseases mentioned, and would contract them as soon as they were removed into an infected area. It is therefore not advisable at present to carry the tick destruction to such an extent that none would be left on a farm.

The notes given above will be useful in themselves to indicate to farmers how they can reduce the number of ticks. There is no risk of losing the immunity in animals if care is taken that a certain number of ticks always remain present on the farm. Theoretically speaking, from the possibilities as explained above, united action throughout South Africa would enable the country to be freed from such diseases as are carried by ticks. Perhaps a future generation will see the advantage of doing so, but under present conditions it is necessary to reserve at least a small number of ticks. The Americans, however, have made up their minds to eradicate Texas fever by destroying the ticks, and their success will perhaps serve as a stimulus for South Africa to do likewise.

The Horticultural Section.

I. SUPPLY OF FRUIT TREES FROM GOVERNMENT NURSERIES.

By R. A. Davis, Government Horticulturist.

The demand for fruit trees grown in the Government Nurseries has again been far greater than the supply. As a result, few applicants were able to obtain absolutely everything they required, and many were unfortunately disappointed in not getting any trees at all.

A word of explanation is perhaps necessary as to how the distribution took place. Many would-be purchasers sent in their orders from 1st May right up to the 15th. Now, the notice in the April issue of this journal stated that "no orders will be booked before that date," consequently all orders received previously to the 15th were laid aside to be dealt with later.

On the 15th orders came to hand for some 10,000 trees, and as there were less than 5,000 in all available for distribution, it is palpable that some of the applicants would be unable to secure what they wanted. The orders were segregated, and all those from farmers received priority, whilst many sent in from the different towns were declined. Even after adopting this method of dealing with the orders there were comparatively few who received all the trees for which they applied.

In all 114 orders were accepted, and the average number of trees allotted in each case was 43.

Of course nothing could be done with those applications sent in before the correct date, neither with the large number which arrived between the 15th and the 31st. There were so many of these that it became necessary to issue a roneo-type circular expressing regret that the orders could not be accepted. Under these circumstances, and by the aid of this explanation, it is hoped that disappointed applicants will deal leniently in their minds with the Government Horticulturist, who, anxious as he may be to further the interests of fruit growing in the Transvaal, is quite unable to make one tree answer the purpose of three.

Whilst on the subject, it may be as well once more to warn intending purchasers of young fruit trees against the most unwise practice of waiting for sales by auction of fruit trees. For nearly seven years now these warnings have gone out through these columns, and last year there were nearly as many sales by auction as ever.

If buyers would only stop to consider, they might know without seeking any illumination from the lamp of science, but by using their own common sense, that at the end of the season all the best trees have been picked out and all the best varieties exhausted. Now, it is only at the end of the season that these sales are held, and as a consequence the trees shipped into the Transvaal for sale by public auction are mostly rubbish, and really more fit for a bonfire than anything else.

One constantly hears complaints about the non-bearing of certain kinds of fruit trees. All the writer can say is, that if people are so foolish as to buy trees at sales they have themselves to blame in a good many cases. Another feature of these sales is the deception which is practised in placing labels on the trees bearing the names of good class varieties, when the trees really belong to some other kind altogether. The writer does not say that this deception is practised wittingly, but that it exists he knows from personal examination on many occasions. Mistakes sometimes arise through the employment of low-priced coloured labour in the nurseries; such labour may seem cheap at the time, but in the long run it costs loss of not money only, but what is of more importance "reputation." It is a pleasure to note that some of our best nurserymen in South Africa, such as Messrs. Pickstone & Co., of Groot Drakenstein, C.C., and Messrs. D. A. English & Co., Natal, never resort to such methods of clearing out their left-over stock.

The right way to purchase young fruit trees is to select first of all the kind best suited to the land to be used for the purpose, and then to write to some good firm of nurserymen and state the requirements. Get quotations from two or three if you so desire, and by all means buy in the cheapest market (not necessarily the lowest priced tree). It is to the interest of these firms to sell you the best they have, for once they get your name on their books they want to keep it there. Their interest does not cease in you when the account is settled, and they very well know that their reputation is at stake, and knowing this they will give you of their best.

It often happens that buyers in this Colony act just as has been suggested. They place the utmost confidence in the firm to which they send, and possibly request the nurseryman to select suitable kinds for their district, or they might look through a nicely got-up catalogue (all fruits are good according to catalogues) and send an order for a dozen different sorts, no one of which is at all suitable for the locality in which they are to be planted. The nurseryman may be an excellent up-to-date man in every way, but he may not know anything at all about the particular district on which advice is asked. And so it is suggested that as the Agricultural Department maintains a horticulturist and four assistants, with experimental stations in different parts of the Transvaal, and co-operative experimental work going on in half-a-dozen other districts, it would probably be wise to write to the Department for information as to what are the best kinds of fruit to plant in a particular locality before sending an order to the nurseryman. These officers are paid to do just such work, and as the whole country is known to them there is little danger of mistakes being made.

Stock Brands Section.

SOME NOTES ON THE BRANDS ORDINANCE AND ITS REGULATIONS.

By J. J. Pienaar, Registrar of Brands.

A few remarks on the following points, which naturally present themselves to every farmer who is not familiar with the requirements of the Brands Ordinance and its regulations, will, it is hoped, be of some use to the stock owner :—

Application for a Brand.

The mode of procedure in connection with the application for a brand has been simplified to such an extent that any farmer can, without the least inconvenience or unnecessary expense, become the owner of a brand, the registration of which entitles him to its exclusive use. Application forms, in both the English and Dutch languages, are obtainable on application to any Resident Magistrate, Field Cornet, or direct to the Registrar of Brands, Pretoria. Farmers should not forget to insert their names in full, the name and number of the farm, the postal address, and the brand for which they intend to apply. The first of the letters in the brand denotes the magisterial district in which it is to be used. The applicant may add to this any other letter of the alphabet, except I and O, which are exclusively used as numerals. The remaining character, which is a numeral, may be left to the discretion of the Magistrate concerned. Nothing, however, debars an applicant from applying for a certain numeral. But there are only three different positions in any combination for any "one" numeral. For instance, in the Potchefstroom District an applicant might fancy the numeral 1 which, owing to its simple pattern, is very attractive. He may apply for PA1, P1A, or 1PA. But, if these are already taken, he would have to select a combination containing another numeral, or advise the Resident Magistrate to take any of the numerals standing vacant in his register.

Registration.

When an application form has been duly completed, the applicant should send it to the Magistrate of the district in which he intends using the brand. In order to obviate unnecessary trouble and correspondence, he should satisfy himself, before despatching the application, that it is correctly filled up, and in every instance accompanied by the registration fee of five shillings.

Where an owner possesses holdings in more than one district, he may register a brand in each such district ; but he is not compelled by the Ordinance to do so, and may use the brand registered in one district on his holdings in other

districts. An owner is, however, not allowed to register more than one brand in any one magisterial district.

Branding Instruments.

To assist farmers, and to ensure accuracy in the making of branding tools, an agreement has been entered into between this Department and a local firm to supply branding irons of any size at 12s. 6d. each, and nose or cheek brands at 9s. each.

How to Brand.

In order to be able to determine who is the first and who is the last owner of an animal bearing two or more brands, the Ordinance establishes an order of branding for all first, second, and subsequent brands. The body of the animal is divided into six positions. The first position is the near rump or thigh ; the second is the off rump or thigh ; the third, near shoulder or top of arm ; the fourth, off shoulder ; the fifth, near ribs ; and the sixth, off ribs. The first brander is, therefore, obliged, in accordance with this provision of the Ordinance, to imprint his brand on position *one*. The second brander may, if there is sufficient room for the purpose, imprint his brand on the same position at a distance of not less than one and a half inches from, and directly underneath, the preceding brand. But if there be not sufficient space for the purpose on position one, then he is compelled by the Ordinance to imprint his brand on position *two*, i.e. off rump or thigh.

It should be clearly understood, however, that no one, although a registered owner, is compelled to brand, and branding may be omitted altogether where a clean skin is preferred, or an owner may trust to a brand already imprinted on an animal for the purposes of identification.

The neatness of a brand depends entirely on the size of the instrument employed, and how it is handled. Branding irons composed of open letters, such as C, E, F, etc., could be made quite small, and would still produce a neat brand. But irons consisting of such complicated letters as B, P, R, etc., should never be made smaller than two and a half inches in height. Even if they are made two and a half or three inches high, the greatest care should be exercised not to make the impression too deep into the hide, for, should the arteries be damaged, the inner portion of the B would eventually become a blotch. All closed letters, no matter how large, are dangerous in this respect.

Heat and time are the essentials in imprinting a satisfactory brand. In heating a three-character branding iron, the use of a forge should be eschewed. My reason for raising this objection is because the forge blows a severe heat in one direction which cannot cover all the letters ; consequently the middle character will be red hot while the outer characters are still cold. Such an iron, when applied to an animal, will roast the place on which the middle character touches by the time the outer characters are able to make a permanent impression.

I should advise the use of a little furnace, which can be made out of an empty coal-tar drum. The drum keeps the heat together, with the result that an iron could be heated within a remarkably short time. With such a furnace the handle of an iron remains cold, which enables the brander to comfortably handle his iron. A cow-dung fire is the next best heating process. But the letters should be well covered so as to obtain an equal heat all over. An iron should never be used until it is red hot, in which case two or three seconds ought to suffice for imprinting a permanent and satisfactory brand.

One should also have regard to the colour of an animal, as this has much to do with the time required for imprinting the brand. White animals, as a rule, have a sensitive skin, whereas dark animals have a hardy skin, not so apt to produce a sore as that of white animals. Thus, where three seconds are employed for imprinting a brand on a black animal, hardly two seconds, with the same heat, should be taken for a white animal. In the case of a black and white beast, care should be taken that the brand, if possible, be placed on one colour only, for if half of the brand is on the black and the other half on the white patch, one or the other part would be unsatisfactory. That part of the brand appearing on the white patch would either become a blotch, or, if otherwise, the impression on the black portion will grow out and eventually become illegible.

Certificate of Sale.

A matter of first consideration in connection with a registered brand is to protect ownership, next in importance comes the alienation of that ownership without exposing the owner of the branded animal to any danger. Some think that a cast (Vent) brand would be sufficient protection to both the vendor and vendee ; but when one considers that any one can make a cast brand, and therewith cast-brand stray animals belonging to other people, it becomes quite clear that such a practice is associated with insurmountable evils.

We boast that none of the brands in our three-piece system are interchangeable, and an owner whose stock are branded with a registered brand is protected from the encroachment of people who make it their business to fake brands. Consequently no one should be allowed to use, or be in possession of an instrument which will enable him to interfere with the advantages to be derived from a registered brand. Cast brands are therefore out of the question.

The only way in which stock owners can be relieved from this difficulty is by means of a uniform system of certificates of sale. Vague certificates (receipts) have been proved in local courts of law to be equally as bad as cast brands.

It took the writer several years to discover the certificate of sale which he now recommends. The certificate and the brand is complementary in that the brand is to identify the animal and the certificate to identify the owner or possessor. This certificate can neither be altered nor forged so as to be used for the purpose of stock theft.

The form is as follows :—

A.D. 252.
ISSUED TO
Uitgereikt aan
JAN PRINSLOO.
(Sgd.) J. J. PIENAAR,
Registrar of Brands.
Registrateur van Brandmerken.
....

CERTIFICATE OF SALE.
VERKOOP-CERTIFIKAAT.

I,......................................hereby certify that I have
Ik, certificeer hiermede dat ik
this day sold and delivered to (Name)................................
heden verkocht en afgeleverd heb aan (Naam)
(Address)..
(Adres)
*.................. ..Animals mentioned in Schedule below.
Dieren vermeld in onderstaande Schedule.
..................................Proprietor.
Eigenaar.
..................................Purchaser.
Koper.

Witness...... ....
Getuige
Date............................
Datum

Number (in Words) *Aantal (in Woorden).*	DESCRIPTION. *Beschrijving.*	Herd No. *Kudde No.*	Brands or Marks. *Brandmerken of andere Merken.*	REMARKS. *Aanmerkingen.*

* State number of Animals.—Geef op aantal Dieren.

These certificates are printed in book form. Each book contains ten certificates, and may be obtained at a cost of 3d. each from the Registrar of Brands, Pretoria.

The right corner of every certificate is filled in at this office. The above illustration shows that the book of certificates was issued to Jan Prinsloo. Jan Grobler's certificates again would bear his name in the right-hand corner. Now say for argument's sake that Jan Grobler wishes to buy cattle from Jan Prinsloo, he cannot use his own certificate to legalise the transaction, because the brand on the animals shows that Jan Prinsloo's certificate should be used, and the only means of getting one of Jan Prinsloo's certificates would be to enter into his coffer, which is highly improbable. From this it will be seen that no one but the owner can use the certificate, and that for the sale of his own cattle. Where there is any doubt as to the validity of a certificate, an Inspector or Police officer in possession of a facsimile of the Registrar's signature can tell at a glance whether it is a bona fide or false certificate.

The system, although original, needs no experimenting. It speaks for itself. Time and unceasing labour were involved

in perfecting it, and the writer will consider himself highly rewarded if, as it is hoped, the Transvaal farmer will be benefited by the use of this simple though practical little document.

DISTRICTS.

The following is a list of the districts showing the *dominant* letter of each district :—

District.	*Dominant Letter.*
Pretoria	A
Bloemhof	B
Carolina	C
Ermelo	E
Piet Retief	F
Middelburg	G
Heidelberg	H
Johannesburg (Municipal Area) ..	J
Krugersdorp	K
Lichtenburg	L
Marico	M
Barberton	N
Potchefstroom	P
Rustenburg	R
Standerton	S
Bethal	T
Wakkerstroom	U
Wolmaransstad	V
Waterberg	W
Witwatersrand (not including the Municipal Area of Johannesburg and the sub-district of Krugersdorp)	X
Lydenburg	Y
Zoutpansberg	Z

It will be seen that either the first or last letter of the name of the district has been assigned to it as a *dominant* letter, with the exception of Bethal, Wakkerstroom, Wolmaransstad, Witwatersrand, and Lydenburg.

The Tobacco Section.

I. TRANSVAAL TOBACCO SEED BEDS.

By J. van Leenhoff, Government Tobacco Expert.

Our tobacco planters in South Africa experience a number of difficulties in the attempt to produce first-class tobacco seedlings at a minimum outlay. During the past year or two some improvements have been made in this direction, but from observation it would appear that the majority of planters still stick to the old methods.

The following description of old and modern methods of preparing and treating tobacco seed beds may therefore be of some interest to planters, not only in the Transvaal, but also in the rest of South Africa.

The following recommendations are based upon a combined knowledge of:

(a) applied methods in vogue in other tobacco-producing countries;
(b) the local conditions in South Africa, in so far as climate, soil, labour, etc., are concerned, of which a careful study has been made during the past three years;
(c) the results of experiments carried out at Pretoria, Rustenburg, Barberton, and the Zoutpansberg Tobacco Experiment Stations.

Old Methods.

As I stated in a previous article, in the Transvaal seed beds are usually made too early in the season. Beds made in April and May have to resist the cold months of June and July, and the seedlings are unable to make good growth if they are not well protected, and if germination and growth take place in the winter months the young plants are exposed to the night frosts, from which, however, they could be protected by the so-called hotbeds. Then again, if one succeeds in raising seedlings under these conditions, they should be ready for transplanting, say, two months after sowing, and this means that the seedlings are transplanted at an unsuitable time, first on account of having no rains during July, August, and September; and secondly, on account of night frosts during these months. Flooding tobacco beds, instead of watering, is also very harmful, as the required amount of water cannot be well controlled in the seed bed; it is the principal cause of the loss of plants in the seed bed, and even if they survive, they are more easily affected by disease, and later, in the field.

On most farms seed beds have been made below the level of the surrounding ground, so that water was actually led on to the beds. Although this may assist germination, the final result is very harmful. Often it will be seen that in the centre of these seed beds the seedlings have all died off. The plants have been practically drowned, and the seed has been sown too thickly. But on the edges of the bed where the seedlings managed to obtain sufficient space, air, and light, and were not affected by excess of water on account of the ground being slightly higher, they did well.

By this system the area of available land is not utilised to the best advantage, and much valuable seed is wasted, which is a serious matter, for the production of very good seed of selected plants is difficult.

It oftens happens also that the whole of the seedlings in the beds are destroyed by mildew or damp-off fungus and other diseases or insect pests. Another disadvantage is that the seedlings become long-stemmed, and possess badly developed root systems which cause weak plants unable to stand the shock of transplanting and which are much more liable to disease than strong seedlings.

Modern Methods.

Selecting the Site.—Choose a spot sheltered as far as possible from cold winds. Winds dry out the seed beds, making it difficult to keep the soil moist enough for germination and growth. If there are no walls or houses for protection, it is advisable to provide hedges for this purpose.

The best soil is a rich sandy loam containing a rather large percentage of sand and humus. A well-worked garden soil is the most suitable, but if only new land is available the latter should first be well worked. A heavy and clayish soil should be avoided, for it checks the development of rootlets and makes it difficult to pull out the seedlings at the time of transplanting.

On account of the great care tobacco seed beds need, it is advisable to choose a spot as near as possible to the planter's house so that due care can be given to them both day and night. Another point is that the soil must be well drained, and at the same time a supply of clear clean water must be handy so as not to lose too much time carrying water to the beds. It is often advisable to have the seed beds on two different spots, so that in case one lot of beds is destroyed by disease, the other set is then at a safe distance from the affected ones. Good judgment must of course be used.

Laying out the Beds.—The next thing to do is to lay out, or mark off, the beds. Experience has proved that beds of three feet wide (inside measurement) are the best to handle. The workers can then easily reach all parts of the bed from either side of it. The beds can be of any length desired.

It is absolutely necessary that the beds should be quite level, and this is a point upon which the length of the bed might depend. In order to economise space, the distance between beds should not be more than absolutely necessary, but there must be sufficient space to allow a passage between the beds for working, and it has been found that a distance of two feet is quite sufficient for this purpose. In this case the actual passage, after the frames have been put up, will be about 18 inches, and this distance will be found quite convenient.

Preparation of Soil.—The preparation of the soil must next be taken in hand. If new ground is to be used, the first working of this soil ought to take place at least three months before sowing; better still about six months or even a year. In that case the laying out of the beds should be done after the soil has been worked up. The final preparation of the seed bed soil should take place after the beds have been laid out, or even after the frames have been put up.

In districts where there is frost during July and August, so-called *hotbeds* should be prepared if the planter wishes to obtain transplanting material in October and the beginning of November. For the later transplanting season this is quite unnecessary, nor is it necessary in the low veld where there is no frost. As the preparation of hotbeds is done after the frames have been put up, the preparation of the ordinary beds is discussed first.

Plate 166. **Sowing Tobacco Seed.**

Seedbeds 10 feet long 3 feet wide, made of Reeds and covered with Cheese Cloth only, for shade in Low Veld.

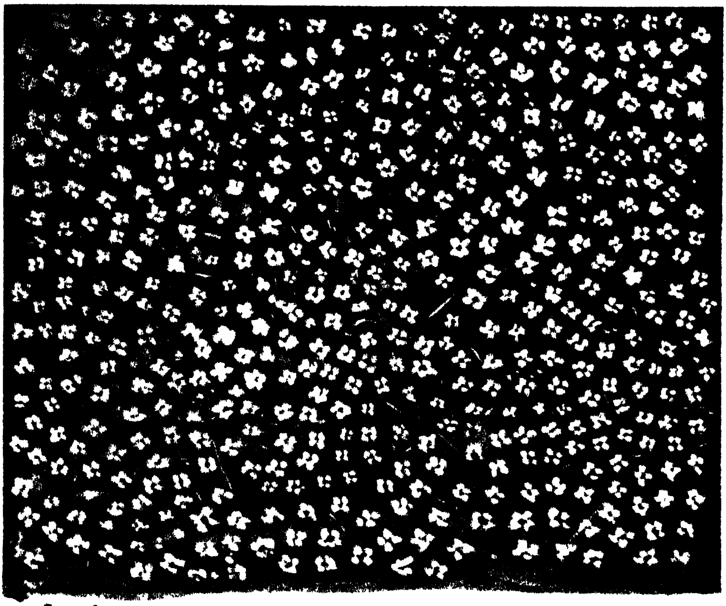

Fig A.

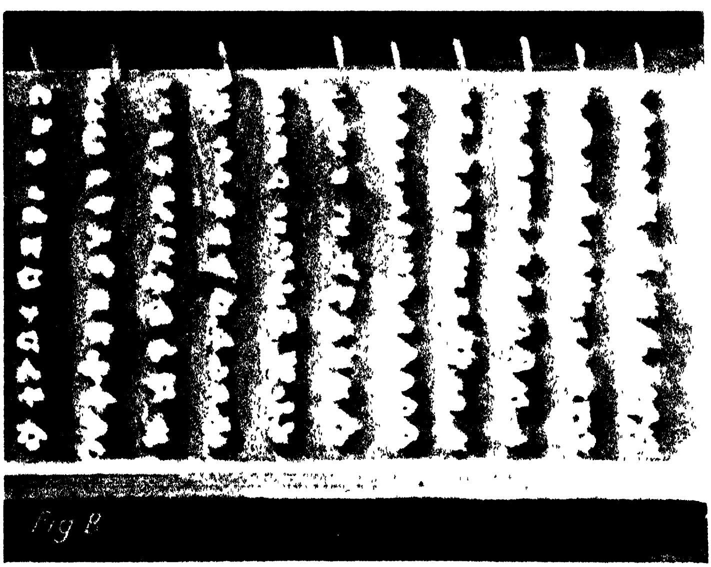

Plate 107

Fig. A. Showing germination of tobacco seed, sown broadcast.
Fig. B. Showing germination of tobacco seed, sown in rows.

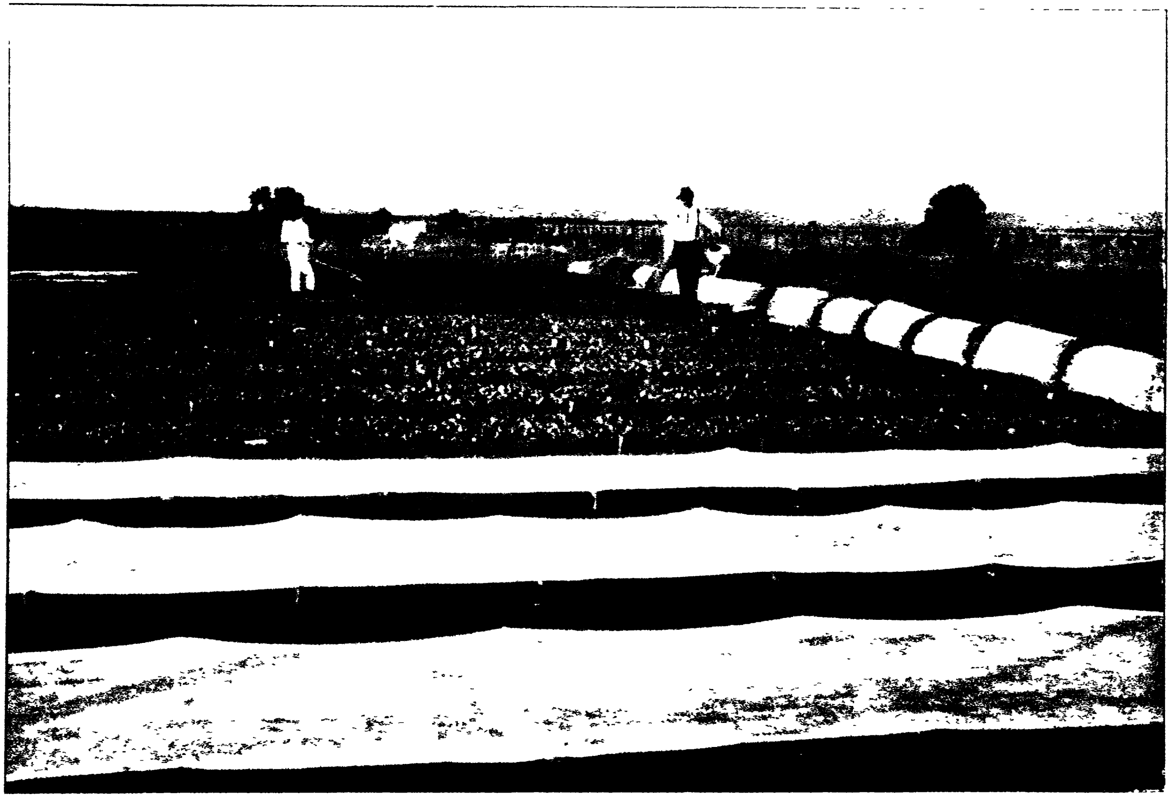

Plate 108. **Showing Construction of Seed-beds on Middle Veld.**
(Rustenburg Tobacco Station.)

Plate 109.

Barberton Tobacco Station.

Good way of pulling out Seedlings.

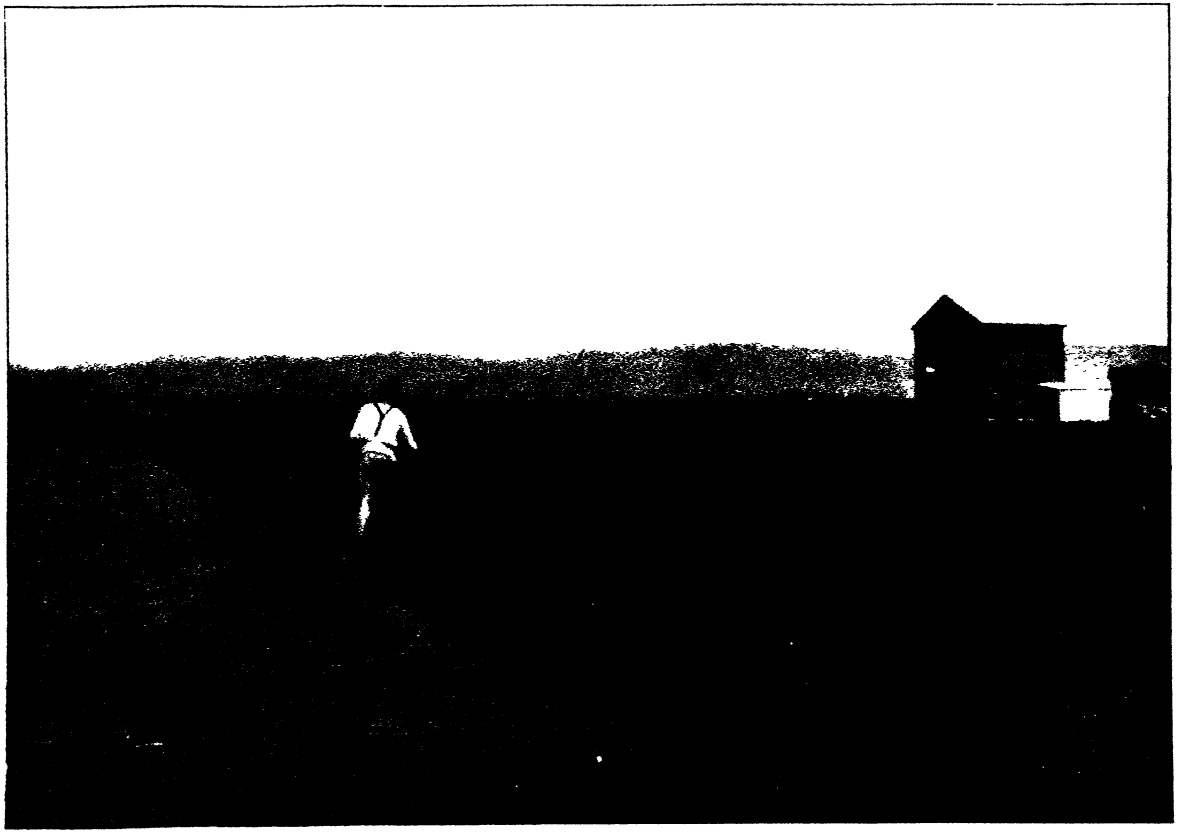

Plate 116

Deep Ploughing at the Rustenburg Tobacco Station.

Plate III.

Tobacco Experiment Station, Rustenburg.

Fig. 1. A field of Velvet Beans ready to be ploughed under.
Fig. 2. Ploughing under of Velvet Beans
Fig. 3. Rondavels for White Staff.
Fig. 4. Another view of the Station with air-curing shed in the middle and tobacco storeroom at the right.

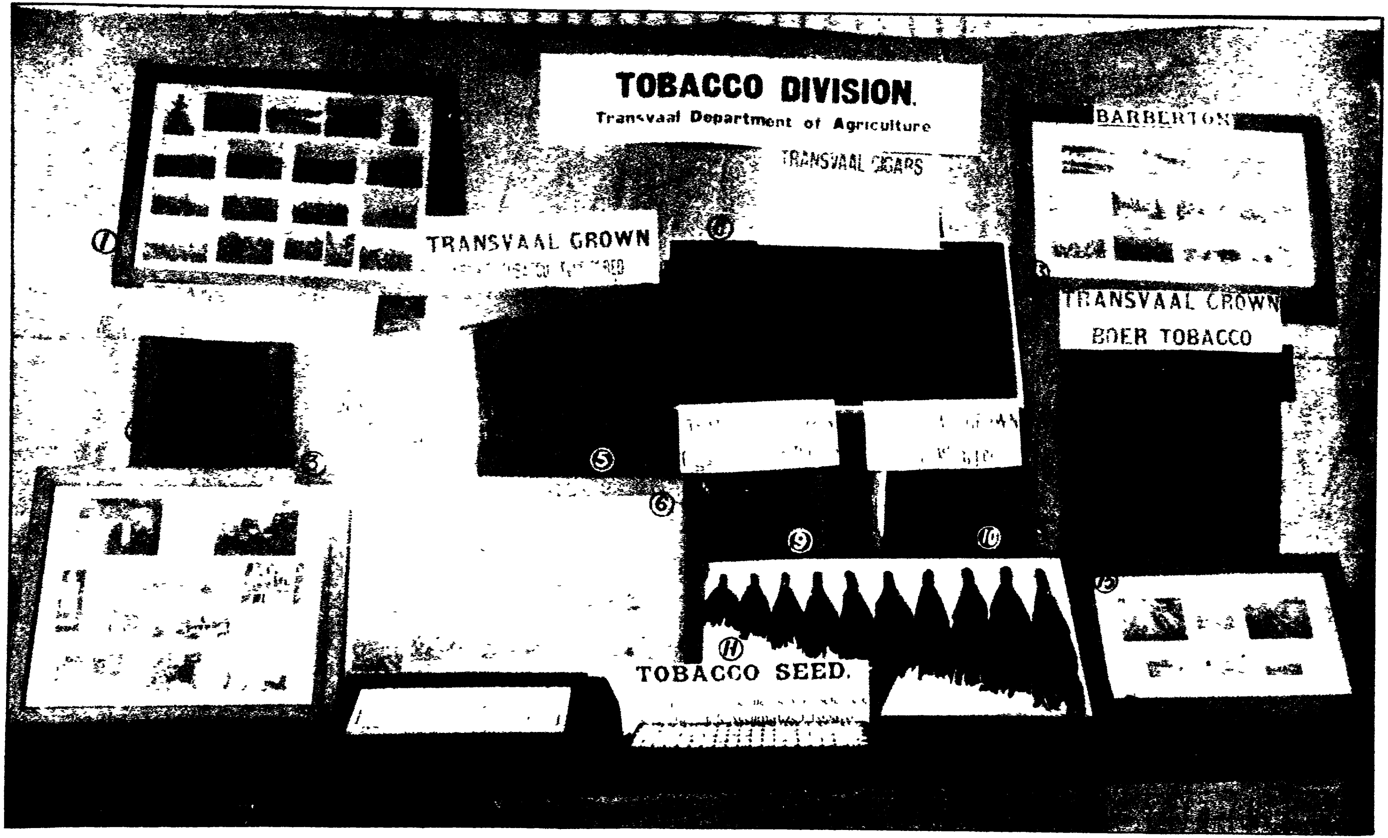

Plate 112. **Tobacco Exhibits at the recent Agricultural Shows.**

The soil of the beds must be thoroughly mixed with well-rotted stable manure. This stable manure should not consist solely of horse or mule manure as these have the drawback of fermenting very rapidly, especially when a little fresh. If some cow manure is added and mixed, it has the advantage of decreasing the production of mushrooms, which otherwise develop largely on beds exclusively manured with horse and mule manure.

The manure should always contain a sufficient quantity of straw, and after it has been well mixed with the soil the beds should remain untouched for a month or more. During the cold months, and from time to time (say once a fortnight) it should be worked to expose the soil to air and sun, and so kill any disease germs that might be present.

If hotbeds are necessary the top soil should be removed to a depth of, say, 10 inches and a layer of about 6 inches of fresh stable manure placed at the bottom. The soil taken out should be mixed with well-rotted stable manure, leaf mould, or any other well-decomposed vegetable matter, and then be replaced on top and further treated as ordinary beds.

Frames.—Frames should be made so as to cover the beds in order to protect them against cold at night and sunshine in the day time, and to keep out flying insects. These frames, however, are not necessary in the low veld or for late beds at the higher altitudes, and these beds should only be protected against excess of sunshine and flying insects by means of grass-mats, or cheese cloth, or muslin cloth, the construction of which is shown in Plate 106.

When frames are to be used they can be made of tarred wooden planks of about 1 in. thick and 10 in. to 12 in. high. Corrugated iron, which is generally present on a farm, can also be used for the purpose in such a way that the frame is about 6 in. above the level of the beds, and so as to receive the cover consisting of grass or cloth, which then cannot touch the young plants. A cheap and good way of constructing these frames is to surround the bed with sundried or, better still, burnt bricks, if possible, which can be easily made on the farm.

Plate 108 shows our seed beds at Rustenburg which are constructed in this manner. They gave excellent results, and at the start of the rainy season (October and November which is the transplanting season) the possible washaways of the sundried bricks do no harm to the seedlings.

Fertilising.—Tobacco seed being very small (about 300,000 to the ounce) the reserve material for the nourishment of the seedling is very soon exhausted, and the seedling is forced to feed itself much sooner from the soil than with most plants. Therefore seed beds must be made in such a way that the seedlings will easily find plenty of available food. If they should not be sufficiently rich in plant food, fertilisers must be added, in addition to the humus which has been previously added in some form and which will keep the beds better provided with moisture.

If fertilisers must be used, I recommend for potash the application of wood ashes, containing, besides other useful elements, a certain percentage of potash ; for nitrogen, sulphate of ammonia, because its nitrogen acts more slowly than in nitrate of soda, and therefore it is better suited for seed beds (dried blood, which contains about 12 per cent. nitrogen, will also be excellent for seed beds), and superphosphates for adding phosphoric acid. If the beds have not received any kraal manure or tobacco stems or stalks, a complete fertiliser, containing, say, 10 per cent. of potash, 4 per cent. of nitrogen, and 10 per cent. of phosphoric acid, all in an available form, may be used. If, after the seedlings have grown up, a doubt exists that there is not sufficient plant food available, a small amount of these fertilisers could be applied in a dilute solution at the

time of watering the beds. The young plants often show lack of plant food by looking yellowish and not fresh green and healthy.

Pulverising.—The upper layer of two or three inches of soil must be well pulverised and all coarse organic matter should be removed. This can be done by sifting. If the proportion of clay appears to be too large some pure sand may be mixed with the surface soil; the advantage of this will be that the beds are better drained, and at the same time they will not dry out and cake so quickly. The rootlets of the young seedlings will also penetrate the soil more easily.

Sterilising.—On our Experiment Stations at Rustenburg and Barberton, we had our seed beds sterilised in a way which gave excellent results, and can therefore be recommended to tobacco planters. This method is as follows:—After the soil has been properly prepared and is in readiness for receiving the seed, boil some water in old paraffin tins or any other utensils at hand, and pour the boiling water as quickly as possible on to the beds so as not to let the water cool off too much, and allow it to soak in to a depth of about six inches. Repeat the treatment once or twice on one or two consecutive days. Sow the seed after the beds have dried up a little. This method of treating seed beds has resulted in our experiencing no trouble from fungus diseases or insect pests, notwithstanding the fact that on some of the beds fresh stable manure had been used. The application of boiling water on the beds not only seems to practically sterilise the surface soil, destroying disease germs and insects that may be present, but also destroys the weed seeds present, which would otherwise produce weeds and interfere with the growth of the young tobacco seedlings.

Our method of applying water on the beds is a cheaper and simpler method than steaming the beds and far better than the method of burning them, adopted in some parts of America.*

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* In America it is the general custom to burn the soil of the seed-beds by burning grass and logs on top, previous to sowing. The object seems to be to destroy the weed seeds, which are mainly present in the upper two inches of soil, and which are killed off by burning or heating the bed. Another advantage is that by burning, certain mineral plant-food, as for instance potash salts, is made more available for use by the plant. But the important *organic matter* or humus is largely destroyed by burning, which liberates the nitrogen, reducing the amount available for plant-food, and the destruction of the humus largely reduces the moisture-retaining capacity of the soil, which is a most important drawback with our climatic conditions in South Africa. Scarcity of wood for burning has led to the invention of a tobacco-bed burner, which is a movable device especially designed for burning seed-beds. *It is thought, however, that for our South African conditions burning is not advisable.*

Methods have also been devised to steam the soil of seed-beds. Mr. Ingle, late Chief Chemist of this Department, devised and described such a method in a previous number of this *Journal*. Mr. A. D. Shamel, of the United States Department of Agriculture, has also devised a method which seems to be in practical and successful use in Connecticut, and which is described as follows:—"A steam-pan is made of sheet-iron 10 feet long, 6 feet wide, and 6 inches deep. Attachments are made which provide for the introduction of steam into this pan and for the connection of the steam hose or pipe running from the steam boiler to the pan. This steam hose should be at least 1 inch in diameter and 50 feet long, so as to permit the supply of an abundance of steam and in order that the box may be moved without moving the steam boiler. The soil for the seed-bed is fertilized and prepared in the same manner as for the sowing of the seed. The pan is turned over a section of this prepared soil and care is taken that the edges of the pan sink into the loose soil, so as to prevent the issue of steam from beneath the edges of the pan. The steam is now turned into the pan, and being confined under the pan, under pressure, it rapidly heats the soil to the desired depth. A strong pressure should be maintained on the steam boiler and a full supply turned into the pan. In the beginning the temperature of the heated soil should be raised to 175° F. to a depth of at least four inches, and this temperature should be maintained for about one hour. This treatment destroys weed seeds and disease-germs in the soil, and improves the condition of the seed-bed soil for the growth of tobacco seedlings. About 600 square feet of the bed surface can be treated in one day by this plan. The tobacco seed should be sowed the following day and lightly raked in."

This method appears to be quite effective, but it may prove too elaborate and too expensive for our farmers.

Quality and Quantity of Seed.—One ounce of tobacco seed contains from 300,000 to 400,000 seeds, but owing to the smallness of the seed and the fact that a considerable percentage of it may not be good, 30,000 to 40,000 is considered a good average yield of seedlings from one ounce of seed. Even on this basis it is the custom of tobacco growers in oversea countries to sow about three times the amount that will actually be required to plant on a given area.

In the Transvaal most of the tobacco planters do not measure the quantity of seed to be used for a certain area and consequently sow too thickly, which causes a great deal of loss through disease and even then produces only weak seedlings. During our experiments on our tobacco stations we have found that to obtain more good and healthy seedlings from one ounce of seed, at least one hundred square yards of bed are required. This is partly due, first to our only sowing well-matured and selected seed, of which the quality is far better and the germination power much greater; secondly, to our beds being well prepared. It must always be remembered that in order to raise good, strong, and healthy seedlings, *it is much better to sow too little than too much seed.*

Seed.—On account of the care and expense that have been devoted to making and preparing the seed beds the importance of using only well-bred, thoroughly cleaned seed which is tested for germination, will be evident. For the main crop only seed should be used of plants which are grown on the farm, and these should be specially selected plants. The seed should be selected from bagged plants of the finest type, from the main terminal flower-cluster, from the largest and strongest capsules (seed pods) after having taken off the smaller and weaker ones, having only about sixty capsules to the crown stalk, and finally the heaviest seed must be separated and the light seed be discarded. A full description of how to select plants for seed production will be found in Farmers' Bulletin No. 28, which is issued to tobacco planters free of cost on application to the Government Printer.

If newly introduced seed is to be used it should only be done on a small scale; from these plants enough seed can be saved of varieties or types which prove successful and which produce a good marketable leaf.

Seed for the main crop should have good vitality, a condition which can be easily tested by placing one hundred seeds between two moist blotters, keeping them moist between two plates for a sufficient length of time to allow the seed to germinate. The percentage of seeds that have germinated in a certain number of days (six to ten days) can then be noted.

Separating Seed.—It is a well-known fact that the use of poor seed is largely the cause of the lack of uniformity in tobacco fields. Before sowing, the seed should be separated so as to remove the light and immature seeds. A very simple way to do this is to pour the required amount of seed into a glass of water and allow it to stand for a while; a part of it will sink to the bottom and the other part will remain on the surface. After removing the seeds from the surface and having emptied the glass, the sunk seed on the bottom should be collected and spread on a piece of paper in order to dry.

Another method of separating the heavy and light seed is by means of a tobacco seed grader, which consists of a glass tube connected to a foot bellows by a rubber tube. About one ounce of seed is placed in the glass tube and a current of air is injected by means of the foot bellows. The strength of this current must be regulated by a valve, so that only the dirt and light seeds will be blown out of the top of the tube. It is

advisable to screen out all the large particles of hulls and trash before putting the seed in the tube. One of these tobacco seed graders has been constructed in our office, and is gladly placed at the disposal of tobacco planters who wish us to separate their seed for them. In the near future specimens of these graders will be placed in different districts for the use of planters.

Soaking Seed.—To provide a quicker germination it is often advisable before sowing to soak the seed in water for about twenty-four hours. This will soften the seed coat and quicken germination.

Mixing of Seed.—If such small seed were simply to be sown broadcast over the bed, it would be impossible to obtain uniformity with regard to the distance between the seedlings; and as has been seen, it is most important that the seed should be sown rather thinly so as to give each seedling at least a square inch of soil for development. It is therefore recommended to take the required amount of seed weighed off for a given area of seed bed and mix it thoroughly with about one hundred times its weight of fine ashes, fine dry earth, or mealie meal. Mealie meal is probably the best on account of its white colour, as the spots where the seed has fallen can be better controlled; it is also useful for its fertilising properties.

Sowing Seed.—The required amount of seed being thoroughly mixed, say one ounce of seed with 100 ounces of mealie meal which amount is required for 100 square yards, it would be best to divide this mixture of seed and mealie meal into ten parts, and sow one-tenth part as uniformly as possible on ten square yards. If the whole amount has been sown at one time it will be found more difficult to obtain the required uniformity. Be careful to see that the bed is uniformly covered, thus ensuring the uniform distribution of the seed. Plate No. 106 shows the sowing as carried out on the Government Tobacco Stations.

After sowing, the seed should be lightly pressed into the soil with a light roller, or by slightly pressing the earth down with a wooden plank. A little pure sand should be spread over the beds to prevent the caking of the top soil and to keep moisture better within reach of the seed.

Plate No. 107, fig. 1, shows seed that has come up at proper distances when sown broadcast as recommended above.

Plate No. 107, fig. 2, shows seed sown in rows at distances of 2 inches, which gave quite good results during our Pretoria tobacco experiments season 1907-08, but this method seems a little too elaborate for commercial crops.

Watering.—The bed should be watered at this stage. The water must be gently applied with a watering can, having a very fine nozzle to prevent the seeds or young seedlings from being washed out of the soil. As explained before, water should not be led over the beds.

If the beds are shaded, watering may be infrequent, but if not shaded the surface of the bed requires frequent slight waterings to keep the tiny seeds from drying out before the plants are well rooted. The surface of the soil should never be allowed to become dry. Frequent drying will weaken or totally destroy either seed or plants. As the plants increase in size the watering should become less frequent and more thorough, and it is then beneficial for the surface of the soil to become dry occasionally. When the plants begin to cover the ground a larger nozzle may be used and the aim should now be to keep the soil moist and the plants dry, i.e. when thoroughly watered the plants, being exposed to the sun, will dry off quickly and the soil being shaded by the plants will remain

moist. Wet plants and an atmosphere surcharged with moisture induce the development of "damping-off" fungus and other diseases. In the Transvaal, with its dry and sunny weather during the growth of the seedlings, there is little danger if water is applied by means of a watering can as described.

Shading.—The beds must be kept covered with grass or reed-mats at night so as to keep them warm, and also during the day time in order to keep the beds dark, as this will facilitate germination. The cover should be lifted at times for ventilation purposes. After the seed has come up the same covering can be used at night during the winter months. During the day time more light should be admitted, although care must be taken to prevent the hot sun burning the plants; therefore, in addition to these grass or reed-mats, cheese cloth or muslin cloth must be used so as to cover the whole bed and to prevent flying insects depositing their eggs on the young plants, as was the case with the splitworm, which last season destroyed a large number of beds and plants on the fields of neighbouring farms. On Plate No. 108 our seed beds at the Rustenburg farm are shown.

Although at first the seedlings must be protected from the hot sun during the day by means of shade covers, they will soon become stronger and healthier; they must then be allowed sufficient light, air, and moisture, by gradually taking off the shade. The shade afforded must be made less as the seedlings grow, so as to harden the plants and prevent their becoming weak and long-stemmed and thereby less able to stand the shock of transplanting and to resist disease.

Remedy for Disease and Insects.—Even if the beds are sterilised it is still advisable to spray them with bordeaux mixture as a preventive of fungus diseases. The preparation of bordeaux mixture has already been described in Farmers' Bulletin No. 27.

For seed beds the proportion should be at the rate of fifty gallons water, three pounds copper sulphate, and two pounds unslaked lime. This spraying could take place after the seed has come up, say once every fortnight.

For insect pests an application of paris green mixture could be given at the rate of one pound of paris green and two pounds of lime to two hundred gallons of water. To prepare this mixture, take the required amount of water and stir in the necessary amount of paris green. Then stir in the lime, which has previously been slaked with water in another vessel. Thoroughly stir the whole and apply with a spray pump.

A great number of beds are yearly lost through white rust or mildew. If this appears in the beds it is easy to save the seedlings by dusting the foliage with sulphur mixed with one-sixth its quantity of quicklime, which will check the disease. This has been tried on the Government tobacco farms and gave splendid results.

Weeding.—When moistening the beds a great number of weeds are likely to appear; these should be pulled out as soon as possible so as to assure the young seedlings a normal development. Weeds utilise the available plant food to the detriment of the tobacco seedlings.

Thinning.—If on some parts of the beds the seedlings come up too thickly they will not get sufficient air, light, and space to develop. The bed must therefore be thinned out. If this is not done there is a great danger of disease making its appearance and even seedlings which survive will become tender and long-stemmed with an undeveloped root system, which is very undesirable.

Size of Seedlings.—The best seedlings for transplanting are those three to four inches in height, having from six to eight leaves. If transplanted when larger it will be found, as there is larger surface for evaporation there is greater risk of dying off, for the rootlets will require a day or two, or sometimes longer, before properly taking hold of the soil. Dead plants can, and must, of course, be replaced by fresh seedlings, but this prevents uniformity in maturity, and the planter must therefore do all in his power to avoid losing plants when set out in the field.

In order to save time and trouble afterwards, the best plan to adopt is to remove and destroy the weak and bad seedlings from the beds at an early date, i.e. those which are yellowish-looking and long-stemmed, also those damaged by insects or disease. If, however, proper care is bestowed upon the seed beds most of the young seedlings will be found to be healthy, and good transplanting material, better able to stand the shock of transplanting, will be available.

Pulling out Seedlings.—To facilitate the pulling of the young seedlings and to decrease the risk of damaging the leaves, and more especially the rootlets, the seed bed should be thoroughly soaked with water before this work is commenced.

If the seed has been thinly and evenly sown it will be found that the pulling out can the more easily be done. I do not recommend that all the earth should be shaken and washed off from the roots of the seedlings, as is sometimes advised, for by the latter method the risk of damaging the rootlets is increased, whereas, by adopting the former method the seedlings will take root more easily and quickly when set out in the field.

When taking seedlings from the bed use a pointed stick, and by running this under the rootlets and then giving it a twisting motion, the soil around the plant is loosened, and by taking the latter by the tips of the top leaves it can be lifted from the soil with most of its roots intact. Do not take hold of a seedling by the growing bud, for by so doing you will bruise it. Plate No. 109 shows the proper method of pulling out the seedlings as practised at our tobacco stations.

Transporting Seedlings to Field.—Pack the seedlings carefully in a shallow basket provided with a handle, and keep it covered so that the young plants are protected from the air and sun. If the field is close at hand do not lift too many at the same time. A little loose damp earth, sprinkled amongst the roots of the plants and to slightly moisten and cover the tops, enables the seedlings to withstand the exposure entailed by a longer journey. If this is done the plants can be transported some considerable distance, provided they have been properly packed. Good results may be obtained, even if they are not set out until the following day. This is, however, not to be recommended unless absolutely necessary.

II. PREPARING TOBACCO LANDS.

By J. van Leenhoff, Government Tobacco Expert.

The preparation of tobacco soils has already been discussed in previous articles in this Journal, and it is therefore unnecessary to again point out the great importance of careful selection, manuring, and preparation of the land. A visit to the Government Tobacco Experiment Station will

show how our soils are worked, the manner in which fertilisers are applied, and how humus and nitrogen are provided to those soils which are in need of it.

Tobacco farmers in the Transvaal do not, as a rule, plough their soil deep enough. In many cases it is ploughed to a depth of only six inches, and often not more than about four inches. Just now is the right season for ploughing, and I would advise all planters to see to the deep ploughing of their tobacco lands before the commencement of the planting season.

Plate 110 shows deep ploughing in progress on one of our experiment stations, and it will be noticed how nicely the soil is worked to about twelve inches deep. Proper ploughing greatly improves the texture and the water-holding capacity, also increasing the availability of plant-food present in the soil. The thorough preparation of the soil means a quicker growth and better development of the plants, and improves the burning quality and texture of the leaf.

Plate 111, figures 1 and 2, shows a nice field of velvet beans, and the method of ploughing them under. The reason for ploughing under the beans is to provide *humus* (i.e. decayed vegetable matter), which is an important factor in retaining moisture. Sandy soils are considered the best for light tobacco; to retain moisture in sandy soils without humus is practically impossible. In open porous soils humus tends to fill up the spaces between the soil particles, and assists in making the soils more compact. The humus acts like a large sponge, absorbing a quantity of water, so that during a drought it is invaluable as a means of retaining moisture. In many soils it may be said that humus is just as essential as cultivation.

Another advantage of growing and ploughing under velvet beans or other leguminous plants, such as peas, etc., is that the bacteria which form the nodules on the roots of these plants (see Plate 102) have the property of extracting the free nitrogen of the air, consequently providing nitrogenous manure free of cost, except that of the seed and of planting.

III. GOVERNMENT TOBACCO EXHIBITS AT RECENT AGRICULTURAL SHOWS.

By J. van Leenhoff, Government Tobacco Expert.

The Government tobacco exhibits at the agricultural shows last season were intended as object lessons to tobacco farmers, and also to show the tobacco possibilities of this Colony. It is thought that a short description of the exhibits as shown on Plate 112 will be of some interest to the readers of this Journal: the subjects are numbered from 1 to 15.

No. 1: A frame containing seventeen pictures showing various stages of our cigar wrapper tobacco experiments at the Experiment Station, Skinners Court, Pretoria.

No. 10 is a sample bale of cigar wrapper tobacco produced at Skinners Court Station, on which manufacturers reported very favourably.

No. 8 shows a box of 630 cigars. These cigars were made exclusively of Transvaal tobacco, consisting of :—

Wrapper: Shade-grown leaf, Pretoria Tobacco Experiment Station, season 1907-08.

Binder: Rustenburg.

Additional binder: Piet Retief.

Filler; Blending of tobacco from Barberton, Rustenburg, and Piet Retief.

No. 9. Cigar filler and binder tobacco grown on the Barberton Tobacco Experiment Station; fermented, sorted, and packed in our tobacco rooms. It is thought that the time is not far distant when the cigar industry will be established.

No. 4 shows fourteen pictures of our tobacco workrooms at Pretoria, where the crops of our experiment stations and those of various farmers are handled.

No. 11 shows the result of sorting "hands" of tobacco into sizes.

Nos. 2 and 14 represent two bales of tobacco from private planters treated, sorted, and baled in the tobacco workrooms. Manufacturers expressed their opinion that when tobacco is treated in this way its value is considerably increased.

No. 7 is a plan of the proposed Central Tobacco Warehouse, Pretoria, in which it is intended to receive, treat, and bale the crops received through the Tobacco Planters' Co-operative Societies, as described in an article which appeared in the last issue of the Journal.

No. 6: A frame of fourteen interesting pictures dealing with the crops on the Rustenburg Experiment Station. At this station experiments are conducted in the production of bright tobaccos, for which at present there seems to be an almost unlimited demand by cigarette manufacturers.

No. 3 shows a plan of a model flue-curing shed. All bright tobaccos should be flue-cured as described in Farmers' Bulletin No. 10.

No. 5 represents a bale of bright tobacco produced on the Rustenburg Station. This tobacco was considered of very fine quality, and it was favourably reported upon by cigarette manufacturers. It has, therefore, been proved that this class of leaf can be produced, provided the necessary care is bestowed upon the crop, but special skill is required to make it a complete success.

No. 12 is a specimen case containing specially selected types of seed, which are kept for further work.

No. 13 shows eleven photographs taken on the Barberton Tobacco Experiment Station, where special attention is devoted to the production of cigar and heavy tobaccos.

No. 15: This is a frame containing six pictures showing certain features of the old methods of tobacco culture in the Transvaal.

The excellent results obtained show how important it is to continue the tobacco work on the lines already started.

The Household Science Section.

I. THE OBJECTS AND PROCESSES OF COOKING.

By Miss Mabel L. Hooper, L.C.A., Principal, Government Cookery School.

Cookery is not only an art, but a science as well, the great object being to make food more palatable and easier to digest. The best definition of cookery is: "The preparation of food in such a way that man shall derive the greatest nutrition and aesthetical advantage from its consumption."

To cook well is a valuable accomplishment as it means making the most of nature's gifts; varied and good cookery are both economical and essential, because the better the cooking, the more easily is the food assimilated and digested, while varied cooking is essential to provide successfully the requirements of our complex bodies. Good cooking is especially of importance in every-day life, for here lack of knowledge results in extravagance, discomfort, and disease.

It is necessary to eat food to repair the wastage of the tissues of the body and also to supply the combustible materials which maintain the forces of the body; food can be taken in its crude or uncooked state or it can be cooked. Many foods, especially those of the vegetable kingdom, cannot be digested by man while in their uncooked state; in such cases cooking is actually the preliminary process of digestion. The following are the reasons for cooking food:—

1. Cooked food is more easily broken up and reached by the digestive juices.
2. It is rendered more attractive; this applies especially to meat, which is very repulsive in its raw state. When cooked the smell is tempting, and this stimulates the appetite and promotes a flow of the digestive juices.
3. Certain chemical changes take place during cooking, the most important being that the starch granules are broken up and the starch is partially converted into *dextrin* (a substance more soluble than starch), and the connective tissue is converted into gelatine.
4. Greater variety of food is obtained.
5. The warmth of the food aids digestion and has a reviving effect.
6. The germs of disease are killed.
7. Putrefaction and decay are retarded by cooking.
8. Cooked food keeps longer than uncooked food.

The knowledge of cookery consists of three branches:—

(*a*) The selection of food and food materials.
(*b*) The preparation and treatment of food.
(*c*) The application of heat for its chemical conversion.

In ordinary cooking the chief agent is heat applied in two ways: (1) By radiation; (2) by direct contact. The following are the different methods:—

(1) Roasting (2) Baking (3) Grilling	Radiant heat.
(4) Boiling (5) Stewing (6) Steaming	Direct contact with boiling water and steam.
(7) Frying	... Contact with hot fat or oil.

Roasting.—This is the name applied to the cooking of meat before a fire, a process now not often followed in an ordinary household on account of the closed cooking ranges in general use. It is an extravagant method of treatment, because a joint loses a good deal of weight when roasted, but no other form of cooking, except grilling, develops such a good flavour. In roast meat this flavour is due to a substance called *osmozome*. This substance is more abundant in brown than in white meat.

To roast a joint properly it should first be dredged with flour and hung close to the fire, as the effect of the heat is to form a crust of coagulated albumen which prevents the juices escaping. After about ten minutes remove it further back to prevent burning and to allow it to cook more slowly. The meat must turn in order to expose all sides to the fire, and it should be *basted* frequently to prevent charring and drying up.

Baking.—This is the process of cooking in an oven, and is the method by which pastry and cakes are prepared. It does not produce such a good flavour in meat as roasting, but it is the usual method which is followed. The same rules apply to baking meat as to roasting. Care should be taken that the oven is well ventilated.

Grilling or Broiling.—This is practically roasting on a small scale, and is the most primitive method of cooking. The fire must be very clear for grilling, and there should be no flames. Salt thrown on to the fire will clear it. Only small, tender pieces of meat are suitable for grilling, as a large piece would be burnt outside before it was cooked through. The meat should be constantly turned to prevent burning, and it should not be pricked by a fork or the juices will escape.

Boiling.—Boiling is one of the most economical ways of cooking, because meat loses less weight when boiled than when roasted; the liquid can afterwards be utilized for soup. Boiled meat is more easily digested than roast meat.

The following points should be remembered in boiling food:—The water should cover whatever is being cooked, and if it is necessary to add more let the added water be boiling in order not to reduce the temperature.

When cooking fresh meat it should be put into fast boiling water to coagulate the albumen outside which retains the juices. After five minutes reduce the temperature and only allow the water to simmer or the meat will become tough and indigestible. Salt meat should be put into cold or warm water to soften it and drain out some of the salt; then the water should be brought to simmering point.

Water boils at 212° Fahr., but very little cooking is done at that point; it is mostly done at 180° Fahr., or simmering point. When water is boiling it bubbles all over; when simmering it bubbles only at the sides. Actual boiling point is only required for (1) vegetables, (2) the reduction of sauces and stock, (3) the making of syrups.

Another object of boiling is to make soups and broth. For these the meat must be cut up and put into cold water, which is brought to boiling point and then allowed to simmer for several hours. This extracts all the nourishment from the meat. Fish must be simmered very gently or it will break up; a little vinegar should be added to the water; it keeps the fish firm.

Stewing.—This is the most economical form of cooking; it is generally defined as a gradual process of simmering in a small quantity of liquor. It has this advantage over boiling that the more soluble and nourishing elements are not separated, but are served with the meat in the form of gravy. The reasons for stews being economical are:—

1. Tough and therefore cheaper kinds of meat can be used as they are made tender and palatable by stewing.
2. There is no waste.
3. Little fuel and little attention are required. Sometimes the meat is fried first and then stewed. This develops a very good flavour. It is the usual method followed when making brown stews.

Steaming.—This, as its name implies, is cooking by contact with steam. In some ways it has its advantages over boiling, but it also has its disadvantages.

Advantages.

(1) Very little of the nutritious element of the food is lost.
(2) Puddings are lighter and more digestible cooked in this way than when boiled.
(3) Fish, meat, and poultry are more tender than when boiled, and remain full of gravy.

Disadvantages.

(1) It is a slower process and therefore more fuel is required.
(2) It is more uncertain; the water may not boil fast enough to produce sufficient steam for cooking.
(3) Meat produces no broth.

Frying.—This is boiling in fat or oil. It is a form of cooking too commonly used. It is extravagant, and, unless properly done, renders food difficult of digestion. There are two methods of frying: Deep or wet frying; and shallow or dry frying.

In *Deep Frying* enough fat is needed to cover the article being fried; the fat must be very hot (i.e. 345° Fahr.). The heat is determined by the fat becoming quite still and a light blue smoke rising from it. Anything fried by this method needs a protection, such as egg and bread-crumb, batter or pastry. If properly protected the food does not flavour the fat, and therefore the fat can be used repeatedly and only needs straining after use to remove any small pieces which may remain; therefore the method is as economical as shallow frying.

In *Shallow Frying* only enough fat is needed to prevent the article of food from burning. Chops and steaks and vegetables are often cooked by this method.

Clarified fat, oil, and lard are used for frying purposes. The first is made from scraps of fat covered with cold water and allowed to boil until all the water has evaporated; then it is strained and is ready for use. Oil needs more careful handling than fat as it is apt to rise and boil over if heated too quickly. Butter is not a good medium for frying; the salt in it causes it to burn before it reaches the requisite heat.

The causes of failure when frying are

(1) an insufficient quantity of fat;

(2) putting the article of food into the pan before the fat is hot enough;

(3) too much moisture adhering to the surface of the article to be fried.

There are two methods of cooking which are not so well known as the above, viz.:—

Sauteing.—This means literally "to toss." Only enough butter or fat is required to prevent burning, and the pan must be moved backwards and forwards while the food is being cooked. Less severe heat is required than for frying. Vegetables are often cooked by this method.

Braising.—This is steaming on a bed of vegetables, and the article of food is partially steamed and partially baked. A proper *braisoir* is a shallow stewpan with a depressed lid on which hot coals are placed, but good results can be obtained by placing the pan in the oven. The *mirepoix* (or bed) is composed of bacon, vegetables, and herbs moistened with stock. Poultry is excellent cooked this way.

The recooking of Cold Meat.—This is a very important branch of cookery to which, as a general rule, insufficient attention is paid. A point to be remembered is that cooked meat should never be recooked, only reheated. To do this properly a protection is needed, such as good gravy, potatoes, egg and bread-crumb, batter or pastry. For example, when making hash, a good gravy is made first with fat, onion, flour, and stock, and well seasoned. The meat should be cut up and placed in this and allowed to get hot in it, but the gravy must not boil once the meat has been added or the meat will be tough and tasteless.

Seasoning.—To season properly is an accomplishment of no mean order, and if properly done it stimulates the appetite, promotes the flow of the digestive juices and thus aids digestion. Condiments and flavouring should, however, be used sparingly, and every care should be taken to preserve the natural flavour of the food.

The subject of seasoning is a wide one and cannot be dealt with at length in this article. I will therefore restrict myself to emphasising one point—that seasoning should only be used to *bring out* the natural flavour of the food and *not to disguise it.*

II. RECIPES FOR THE FARM HOME.

Steamed Liver Pudding.

Ingredients: ½ lb. liver, 2 slices bacon, 1 egg, 1 cupful bread crumbs, milk, onion.

Boil the liver, then put it through mincing machine; cut the bacon into dice, chop the onion, and prepare the bread crumbs. Mix all thoroughly together and season to taste. Beat the egg, and add to it a little milk to bind the whole together. Put into a buttered basin, and steam for two hours and a half.

* * * *

A Nice Way to Prepare Macaroni with Cheese.

Break the macaroni into pieces 2 inches long. Put into saucepan with boiling water, and allow to boil rapidly for about thirty minutes; then drain. Put into a saucepan two tablespoonfuls of butter, add one chopped onion, and allow to cook until onion is soft, but not brown. Add a pint of strained tomatoes and the macaroni. When the macaroni is thoroughly heated add half a pound of grated cheese, half a cupful of milk or cream, and season to taste. Can be served with rice or baked potatoes.

* * * *

Omelet.

Omelet is usually enjoyed for the morning meal, and there is a variety of ways in which it can be made. One method is as follows:—Soak a cup of bread crumbs in a cup of milk over night. In the morning add three well-beaten eggs and a pinch of salt. Pour the mixture in a well greased, moderately hot pan, and cook slowly until it is a golden brown. Then brown it in a hot oven and serve immediately.

Another good omelet is made by using a cup of mashed potatoes, three eggs, and a cup and a half of milk. Cook the same as in the foregoing recipe. Cold meat chopped fine and added to an omelet when it is ready to brown makes an acceptable dish, besides utilising scraps that might otherwise be wasted.

* * * *

Pastry Eggs.

Boil some eggs hard, remove the shells, cover with finely minced cooked savoury meat, then a thin layer of pastry, brush over with egg, and bake from ten to fifteen minutes.

* * * *

Baked Eggs and Cheese.

Put a tablespoonful of butter in a baking dish and melt. Next add a layer of bread crumbs, then one of grated cheese, and upon this break the desired number of eggs. Add a teaspoonful of cream—either sweet or sour—for each egg, dust the top with salt, pepper, and a thin grating of cheese, and bake until the eggs are as hard as desired. Use a hard cheese, and use it sparingly.

* * * *

Cream Toast.

Arrange slices of toasted bread in a deep dish. Have prepared two or three cold boiled eggs; cut the whites of the eggs in thin slices over the toast. Over this place a sauce made from one pint rich milk,

one tablespoonful flour, salt, pepper, and a small piece of butter. Just before serving grate the egg yolks over the top.

* * * *

SAUSAGE CROQUETTES.

Reheat some cold potatoes and mash them smoothly with a little butter and salt, then dredge in sufficient flour to work to a rather stiff paste. Roll potato dough out to about quarter of an inch thick, cut into strips large enough to enclose sausage (partially cooked), fold paste over, slightly wetting edges to make it stick firmly when pinched together, and fry in a saucepan with boiling fat to a nice light brown. Serve arranged in a pyramid and garnished with parsley.

* * * *

BAKED TOMATOES.

Skin tomatoes with boiling water. Chop a good-sized onion very fine, cut tomatoes into slices, and sprinkle the whole with pepper and salt. Butter a baking dish, and arrange tomatoes and onions with layers of bread crumbs and small lumps of butter. Put a thick layer of crumbs on top, and bake in a slow oven for about an hour.

* * * *

The following are the various uses to which the pumpkin can be put:—

CREAM OF PUMPKIN SOUP.

Slice a ripe, small pumpkin into pieces enough to fill a quart measure. Put into a saucepan with a pint of cold water, and season with a teaspoonful each of salt and sugar, a half teaspoonful of pepper, and a few sprigs of parsley. Cover the pan and simmer gently for an hour and a half, stirring frequently. Strain through a colander to remove the skin, and then through a finer sieve; put back into the pan, sprinkle over it a heaping teaspoonful flour, and mix thoroughly, Pour over it, stirring all the time, a quart of hot milk. Add a tablespoonful butter, and simmer fifteen minutes. Then add a cup of rich cream and a teaspoonful minced parsley. Heat, but do not allow it to boil.

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SQUASH OR PUMPKIN BREAD.

To one pint of squash or pumpkin, cooked as dry as possible, add one cup sugar, half-cup lard, dripping or butter (melted), half-tablespoonful salt, one cake of yeast, or a small quantity of yeast made into a sponge, with one cup of milk and flour to make a smooth batter; let rise one hour. Form into a loaf or into biscuits like scones, and leave to rise again and bake.

* * * *

SQUASH PIE.

Ingredients: *3 pints of boiled and mashed squash, 3 quarts of boiling milk, 1 heaping pint of sugar, 5 eggs, 3 heaping teaspoons of flour, piece of butter as large as a walnut, half a nutmeg (grated), 1 level teaspoonful salt, 1 level teaspoon cinnamon, grated rind of one lemon.*

Put sugar, spice, salt, and butter with the squash, and beat thoroughly as you pour over the hot milk, then add beaten eggs and flour, and beat well; bake with under crust only.

Scalloped Squash.

Boil and mash squash, let it cool, then add beaten yolks of two eggs and three tablespoonfuls of milk, thickened with flour and butter (as for white sauce). Season with pepper and salt, pour into buttered dish, cover with bread crumbs, and bake a light brown.

* * * *

Pumpkin, Italian Style.

Peel some slices of pumpkin, put in salted water, and cook fifteen minutes, then drain. Put a generous piece of butter in the frying pan, and as soon as hot lay in the sliced pumpkin, sprinkling with salt and pepper. Toss over the fire a few minutes, then lay the slices in a buttered baking dish. Pour the melted butter over them, sprinkle grated cheese on top, and bake until nicely browned. Serve very hot.

* * * *

Pumpkin Croquettes.

To two full cups of pumpkin, cooked and mashed, add seasoning to taste, of salt and pepper, a tablespoonful butter, two tablespoonfuls milk, and the beaten yolks of two eggs. Mix well, put into saucepan, and stir over the fire until the pumpkin leaves the sides of the pan. When cold make into rolls about an inch in diameter and three inches long; dip in beaten egg, then in crumbs, and fry in boiling fat. Drain on soft brown paper.

* * * *

Pumpkin Chips.

Select a good, sweet pumpkin, halve it, take out the seeds, and cut in chips the size of half-a-crown. To each pound of the pumpkin allow a pound of fine white sugar and a gill of lemon juice. Put the chips in a deep dish and sprinkle on each layer a layer of sugar, then turn the lemon juice over the whole Let this remain for a day, then boil together, allowing a cup of water to each three pounds pumpkin, with a tablespoonful ground ginger tied up in bags and the yellow peel of the lemons cut in shreds. When the pumpkin becomes tender turn the whole into a stone jar, and set away in a cool place for a week. At the end of that time pour the syrup off the chips, boil down until thick, then turn back over the chips and seal.

* * * *

Salted Pumpkin Seeds.

These salted seeds are appetizing to use in place of salted nuts. To prepare them wash the seeds free from the sticky shreds that surround them, then dry in the sun or a rather cool oven. When ready to salt spread on tins, salt liberally, then set in a hot oven, and shake and stir until crisp.

* * * *

Pumpkin Jam.

Those of our readers who have not yet tried to make jam from pumpkin will not be able to realise what a delicious jam it makes.

Select a nice ripe pumpkin, remove the seeds, peel it, and cut into small squares. To 6 lbs. pumpkin use 3 lbs. of sugar. Cover the pumpkin with sugar and leave over night. The following morning put on fire, add four lemons cut into thin slices, and allow to cook until done. A few pieces of bruised ginger or a few pieces of dried naartje peel adds greatly to its flavouring.

Pumpkin Fritters.

Ingredients: *4 pints cooked and mashed pumpkin, 6 ozs. flour (or sufficient to make fairly stiff batter), 2 eggs, ½ cupful sugar, 1 teaspoonful baking powder, cinnamon.*

Mix all ingredients well together, and fry a nice brown in hot fat. Mix a little cinnamon and sugar together, strew over fritters, and serve hot.

* * * *

Banana Omelette.

Slice two or three bananas crosswise and fry them lightly in a little butter; keep these hot while making the omelet. Beat together three eggs, season with pepper and salt, and add a tablespoonful of thin cream. Melt some butter in the omelet pan; when this is hot pour in the egg-mixture and stir gently for a moment or two, and then allow it to cook until the bottom begins to set; lift the edges now and then and let the uncooked egg run underneath. When done, lay a slice or two of banana on one side and fold the omelet over. Lay on hot platter, and surround with the fried bananas.

* * * *

Hasty Pudding.

Ingredients: *2 ozs. butter, 2 ozs. castor sugar, 2 eggs, ¼ lb. flour, ½ pint milk.*

Cream the butter and sugar together till they look like thick cream, add the eggs one by one, then the flour and milk stirred lightly in. A little flavouring, such as vanilla or lemon, is an improvement. Put into a greased pie-dish, and bake about half an hour. Serve with jam, custard, or a sweet sauce.

* * * *

Rice Blanc Mange.

Boil three-quarters cupful of rice in milk; when cooked add half a packet of gelatine dissolved in a little cold milk; add sugar and vanilla to taste. When cold, beat in one quart of well-whipped cream. Serve with canned fruit or raspberry juice poured over it.

* * * *

Honey Cakes.

Ingredients: *1 oz. butter, ¼ lb. honey, ½ lemon, 1 oz. sweet almonds, ¼ lb. flour, 1 spoonful bicarbonate of soda.*

Put the butter into a saucepan, and, when melted, add the honey; let it boil, stirring briskly all the time; take it from the fire, and, when slightly cool, add the finely minced rind of half a lemon, the almonds blanched and finely pounded, a saltspoonful of nutmeg, the flour, and lastly the soda dissolved in half a gill of warm water. Leave the mixture in a cool place for twelve hours; roll out, cut into small square cakes, put a thin piece of candied peel in the centre, and a split almond at each corner. Bake twenty-five minutes in a moderate oven.

* * * *

A Loaf of Fruit Cake.

Ingredients: *4 cups of flour, 1 cup butter, 1 cup sugar, 1 cup treacle (or golden syrup), 1 cup milk, 4 eggs, 1 teaspoonful soda, 1 lb. raisins, ½ lb. citron, 1 teaspoon each cinnamon and cloves, 1 nutmeg (grated).*

Place the flour on a baking pan and set it in an open oven to dry and slightly brown. Stir it occasionally and cool before using. Beat sugar and butter to a smooth cream, and add treacle and milk. Beat the yolks and whites of eggs separately, and add the yolks to sugar and butter. Sift the flour with soda; seed and chop the raisins and slice the citron; mix the fruit together and stir it into the flour; then mix the spices together and add to the sugar and butter mixture; then add the flour, and, lastly, the whites of eggs. Have ready a pan lined, pour in the mixture, and bake at least four hours. Should it incline to burn on top, cover with several layers of paper, and place a small pan of cold water in the oven. When done cover with icing, wrap it in waxed paper, and keep it in an earthen jar with a tight cover.

This cake is comparatively inexpensive, and it improves with age—it will keep for several months, and is excellent for a standby, not too rich, yet of perfect and exquisite flavour.

* * * *

Pickled Eggs.

Boil one dozen eggs ten minutes, remove the shell, and lay in a jar. Add to one quart of vinegar 6 whole spice, 12 peppercorns, ½ oz. bruised ginger, 4 cloves, and some salt; bring to the boil, then pour over eggs. When cold tie down and use in a month.

* * * *

Pickled Walnuts.

Walnuts should be pickled before the shell hardens. It should be easy to pass a fork through them. Hold the walnut on one fork, and with another prick them well. It is advisable not to handle them more than can be avoided, as the stain is particularly difficult to remove from the hands. Having well pricked the walnuts, place them in a basin and pour brine over them, made in the proportion of 2 lbs. of salt to half a gallon of water. Let them remain a week, changing the brine once during that time. Remove them from the pickle to flat dishes or trays, and place them in the sun to blacken; turn them about, so that they may blacken all over; two or three days will be sufficient time. When quite black put them in dry jars and pour over the following pickle. Take a quart of vinegar and add to it 1 oz. all-spice, 2 oz. whole black pepper, 1 oz. of whole bruised ginger, and ½ oz. cloves. Boil this for ten minutes, and pour whilst nearly boiling over the walnuts. Tie down and keep in a dry place. Will be ready for use in three or four weeks.

* * * *

Canning Meat at Home.

As it is not always an easy matter in the country to have fresh meat during hot weather, the following recipe, taken from *The New Zealand Farmer, Stock and Station Journal*, may be of use to our farmers' wives:—

Put the raw meat in wide-necked bottles, pack it closely, and then put the bottles in warm water, which is slowly brought to the boiling point. The bottles should be set on blocks of wood or on straw to prevent breakage. After boiling long enough to expel all air, cover the top of the meat with lard and seal up tightly. Meat can be kept in this way perfectly sweet for months—even in midsummer—if it is fresh when put into the bottles.

Sulphur Fumes for Fruit Preserving.

Though the following method for preserving peaches, apples, pears, and tomatoes would not at first sight seem very likely to be successful, yet, according to the *Queensland Agricultural Journal*, March, 1909, it may be adopted with confidence. Peel peaches, or other fruit, cut in halves, remove seeds, put in a wooden tub having a hole in the centre for the vessel containing the sulphur. If four gallons of fruit are required, prepare enough for six gallons to allow for shrinkage. Place sulphur at the rate of one teaspoonful per gallon of fruit in the tub, ignite the sulphur, and cover the tub for four hours. Remove the fruit, place in stone jars, and cover. According to the journal quoted, fruit preserved in this way keeps fine all winter, and tastes like fresh fruit.

Crystallization of Fruits.

As we have received several enquiries regarding the crystallization of fruits, we publish the following, taken from the *Boston Cooking School Magazine*:—

"As fruit preserved by this process needs to be dried at a fixed temperature, and as the last step in the process—crystallization—requires special apparatus, it is rarely attempted at home. Recipes that can be followed by amateurs are not readily procurable.

Recipe.

"Stone the fruit—cherries, plums, etc.—and weigh. Take half the weight of sugar, with one cupful of water for each half-pound of sugar; cook until the syrup drops from a spoon in beads; add the fruit without the juice, and return to the fire for five minutes without boiling; pour all into a bowl; let stand three hours, then drain the syrup from the fruit, add sugar equal to one-fourth the first weight of the fruit, melt, then boil until it drops in beads; add the fruit, let it boil up once, and return the whole to the bowl. After four hours strain off the syrup, add one-fourth the first weight of the fruit in sugar (making in all just the weight of the fruit in sugar), and cook once more until it drops from the spoon in beads; add the fruit and boil up once. Set the pan on the back of the stove for five minutes, but without boiling; turn into glasses, and, when cold, cover with papers dipped in brandy or alcohol. Fruit preserved in this way will keep indefinitely, but when it is to be crystallized this is only the first step in the process.

"Drain the fruit from the syrup, wash and dry in an even temperature. When very dry arrange in a single layer, side by side, in a candy pan, having a grate on the bottom. Arrange other grates above (filled with fruit, having the last layer slightly below the edges of the candy pan). Cover the last layer of fruit with another grate, with a weight above it, to keep the fruit beneath the syrup. Cover the fruit with a hot syrup registering 34° by the saccharometer, and set aside in a hot closet for twelve hours; at the end of that time drain the fruit from the syrup, lay it on dry grates, and leave it till very dry. If the fruit is not covered with a sufficiently thick layer of candy at the end of twelve hours, let it remain in the syrup longer."

III. CONTRIBUTORS' COLUMN.

Readers are requested to send in their favourite recipes. Suggestions, ideas, and contributions of any kind—pertaining to the house—will be gladly received. Address to:—Jeanette C. van Duyn, Department of Agriculture, Pretoria.

We desire to thank the contributors of the following recipes:—

Fanko Cheese Soufflé.

Ingredients: 1 *quart milk*, ½ *lb. Gruyer cheese*, 2 *eggs*, 1 *tablespoonful butter*, *fanko flour*, (*or finely ground mealie meal*).

Into the quart of boiling milk stir as much fánko flour or mealie meal as will stiffen to the consistency of ordinary porridge. Add the cheese, grated, season to taste with salt and cayenne, and boil gently for about twenty minutes. Take from the fire and, when slightly cool, add the eggs—whites and yolks beaten separately—also the butter. Bake in well-buttered patty pans and serve hot.—Mrs. Fleming.

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We are indebted to Mrs. J. Burtt-Davy for the following seven recipes:—

American Recipe for Brown Bread.

Ingredients: 3 *parts boer meal*, 1 *part maize meal* (*or white flour, or mixed*), 2 *teaspoons salt*, ½ *teacup sugar or syrup*, ¼ *teacup yeast* (*or half a dried yeast cake*).

Mix ingredients together with enough water to make quite a stiff batter, which will just drop from a spoon, and set to rise. When risen, stir in one even teaspoonful soda dissolved in a little warm water, beat to mix thoroughly, and put into small bread pans. Bake slowly and evenly in a good oven

Hoe Cake.

Brown together in the oven one cupful maize meal, two tablespoonfuls flour, one teaspoonful sugar, and one-third teaspoonful salt. Have one-half cupful of rich hot milk and add to the mixture, beating till cold. Add beaten yolks of two eggs, lastly fold in whites beaten stiff, and bake twenty minutes on hot oiled tins

Tamale de Castel.

(*Maize Meal Pot Pie.*)

Cut into small slices about one pound of pork or chicken (or both mixed), add a little salt and boil till tender; scald one quart of maize meal, add salt and four tablespoonfuls of butter; stir into this a handful of flour and two beaten eggs, and add enough broth to make a batter. Take half a can of tomatoes, add a little butter, and two tablespoonfuls of chili powder, and cook until well done. Add this to the meat and mix well. Now line some pie pans with the meal mixture, then put in the meat in layers as for chicken pie, bake very slowly, and, when nearly done, dress over with butter to brown.

BANNOCK.

Ingredients: *2½ cupfuls boiling water, ¾ cupful coarse maize meal, ½ teaspoonful salt, 1 tablespoonful butter.*

Put the boiling water in a saucepan, add salt and butter, and stir the meal in slowly. Continue stirring and boiling until the mixture is smooth, thick, and stiff. It will probably require fifteen minutes. Have ready on the stove some buttered tin sheets, very hot. Take a spoonful of the batter at a time and drop little rounds on the tins. Let them cook on top of stove for a few minutes, then bake in the oven for about a quarter of an hour.

* * * *

SWEET MAIZE MUFFINS.

Ingredients: *1 heaping cupful maize meal, 1½ cupfuls flour, 2 cupfuls milk, 2 tablespoonfuls butter, 4 tablespoonfuls sugar, 1 teaspoonful bicarbonate of soda, 2 teaspoonfuls cream of tartar, ½ teaspoonful salt, 3 eggs.*

Mix the maize meal and other dry ingredients together except the soda and sugar, and rub the mixture through a sieve. Beat butter and sugar together until creamy, add yolks of eggs, and beat well. Beat whites to a stiff froth. Dissolve the soda in the milk and add to the sugar, butter, and egg mixture. Now add the sifted dry materials, beat well, and finally stir in the whites of eggs. Put into buttered muffin tins and bake in a quick oven for about half an hour.

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VIRGINIA SPOON BREAD.

Ingredients: *1 quart sweet milk, 1 cupful white maize meal, 1 teaspoonful salt, 2 tablespoonfuls butter, 2 well-beaten eggs.*

Heat one pint of milk to boiling point, stir in the meal and salt, and cook for five minutes. Beat in the butter and half a cupful of cold milk, add the eggs, and beat once more. Beat in the rest of milk gradually. Put into granite or tin pan, and bake for half an hour in a rather hot oven. Be particular to serve at once, in the baking pan.

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SPICED CAKE.

Ingredients: *1 cup sugar, 1 cup syrup, 1 cup butter (or dripping), 2 eggs, 1 cup water, 3 cups sifted flour (or enough to make stiff batter), 1 teaspoonful ground cloves, 2 teaspoonfuls each of ground cinnamon and ginger, 1 tablespoonful vinegar, ½ cupful raisins, 1 cupful dried apples, 2 teaspoonfuls bicarbonate of soda.*

Soak apples till tender, then add raisins, and boil together with syrup, sugar, and spices; let cool and add other ingredients, lastly soda dissolved in a little warm water and vinegar. Bake for about two hours. This cake improves with keeping.—A BURTT-DAVY.

MAIZE MEAL CAKES.

Ingredients: *3 cups maize meal, 1 cup flour, 3 tablespoonfuls sugar, 2 full teaspoons baking powder, 1 tablespoonful melted butter, 3 cups sweet milk, 1 egg, ½ teaspoon salt.*

Mix the meal, flour, sugar, salt, and baking powder together in a basin, add milk, and lastly egg—without beating—and melted butter. Beat all well and bake 35 minutes in a moderately hot oven in patty pans; only fill the tins half-full. Very suitable for breakfast; to be eaten with jam or butter.—Mrs. JAS. VAN DEN BERG.

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TURNIPS AU GRATIN.

Ingredients: *½ dozen large white turnips*, 1 *egg*, *½ cupful bread crumbs, grated cheese, butter, pepper, and salt.*

Boil the turnips in salted water, drain them well, and beat to a pulp with a fork; then add the egg, well beaten, and bread crumbs; season with pepper and salt and mix all well together. Put in a buttered dish, cover with grated cheese, bread crumbs, and lumps of butter, and bake a light brown in a quick oven.—Miss A. TENNANT.

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CREAM PUFFS.

Ingredients: 6 *ozs. flour*, 3 *ozs. butter*, 6 *eggs*, *½ pint water.*

Put water and butter on fire and leave to boil, then put in the flour, sifted beforehand, stir very quickly, and take off the fire. Stir well until it leaves sides of the pan. Work in the eggs one at a time, and beat until it drops from the spoon. Drop on to a well-greased pan and place in a good warm oven. Bake fifteen minutes or more. When cool fill with whipped cream flavoured with vanilla and sugar, or make a soft custard with a pint of milk, one or two eggs, and about one tablespoonful of cornflour, a pinch of salt, sugar, and flavouring.—Mrs. LORENTZ, Klerksdorp.

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QUINCE HONEY.

Ingredients: 5½ *lbs. sugar*, 1 *pint water*, 10 *large quinces.*

Boil sugar and water together for one hour; grate the quinces and add to syrup. Boil all well together for quarter of an hour, and bottle hot.—Mrs. HAYLETT.

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PICKLED CABBAGE.

Cut cabbage into small strips; place in salt water for two days, then rinse thoroughly in fresh water. Boil vinegar with all-spice; when quite cold pour over cabbage, put into jars, and cork well.—Miss G. ANTILL.

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BOILED FRUIT PUDDING.

Ingredients: 6 *tablespoonfuls chopped suet*, 6 *tablespoonfuls flour*, 1 *teaspoonful baking powder, a little salt, fruit.*

Sift flour and baking powder together; then mix all ingredients, with a little water, to a stiff paste and roll out. Grease a basin and line it with some of the paste. Add fruit which has been sweetened to taste, cover with the remainder of paste, and tie up the pudding in a cloth that has been well scalded and floured. Boil for about one hour. The water must be boiling before the pudding is put into it.—Mrs. E. N. CRESSWELL.

QUAKER OATS ROCK CAKES.

Ingredients : *2 teacups quaker oats, 2 tablespoonfuls sugar, 2 tablespoonfuls butter, 2 eggs, 1 teaspoonful baking powder.*

Mix ingredients well together, then bake in hot oven for twenty minutes.—MRS. OTTO WEBER.

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BRITTANY CAKES.

Ingredients: *2 eggs, their weight in flour, butter, and sugar; 1 teaspoonful baking powder, rind of one lemon, cochineal, cocoanut, apricot jam.*

Beat butter and sugar to a cream, mix in eggs well beaten, then stir in flour and lemon rind cut up finely, a little cocoanut, and sufficient cochineal to colour nicely. Drop into patty pans and put a little apricot jam on each cake. Bake about fifteen minutes.—MISS F. BUCKLEY.

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SNOWBALL PUDDING.

Ingredients : *4 eggs, 1 bottle milk, 2 tablespoonfuls sugar, 1 spoonful maizena.*

Beat the whites of eggs to a stiff froth, and put the milk on to boil. Make the white into little dumplings, boil for a few seconds in milk, then take out and drain well. Mix yolks of eggs, sugar, and maizena into a paste, and stir into the boiling milk. Put whites into a pie dish and pour the custard over. Serve cold.—MRS. H. VERMAAS.

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Mrs. Dick Laffine, of Nooitgedacht, Ermelo, has kindly contributed the first three candy recipes, whilst the rest were sent through the courtesy of Mr. C. W. Howard, Government Entomologist, Lourenco Marques:—

MARZIPAN.

Ingredients : *½ lb. ground almonds, ½ lb. icing sugar, 1 white of egg, rose water, and almond essence.*

Pound ingredients well together and cut into round or oblong cakes. Add very little water to ½ lb. icing sugar, and a few drops of rose water. When it is just liquid enough to spread smoothly, but not too thin, pour over the marzipan. Leave plain or decorate with candied violets.

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ALMOND FILBERTS.

Blanch some good-sized almonds, take some marzipan paste as above, colour a pale green with green vegetable colouring, form into filbert-shaped rolls, half-split one side with a knife, and insert an almond lengthwise.

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COCOANUT MACAROONS.

Ingredients : *1 white of egg, ¼ lb. castor sugar, 2 dessert-spoonfuls desiccated cocoanut.*

Whip the white of egg to a stiff froth, add the sugar, and beat again until it stands in peaks. Lightly stir in the cocoanut, put in small rough heaps of an even size on plain paper (not buttered), place on a baking tin and bake in a moderate oven till they are crisp and will come off the paper easily. Cover if necessary to keep them from browning.

VELVET MOLASSES CANDY.

Ingredients: *1 cup molasses (or golden syrup), 3 cups sugar, 1 cup boiling water, 3 tablespoonfuls vinegar, ½ teaspoonful cream of tartar, ½ cupful melted butter, ¼ teaspoonful soda.*

Put first four ingredients into saucepan and place over fire. As soon as boiling point is reached add cream of tartar. Boil until mixture, when tried in cold water, will become brittle. Stir constantly during last part of cooking. When nearly done add butter and soda. Pour into buttered pan and pull when cool enough to handle. While pulling add one teaspoonful vanilla, one-half teaspoonful lemon, a few drops oil of peppermint, or a few drops oil of wintergreen.

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BUTTER SCOTCH.

Ingredients: *1 cup sugar, ¼ cup molasses (or golden syrup), 1 tablespoonful vinegar, 2 tablespoonfuls boiling water, ½ cup butter.*

Boil ingredients together until mixture will become brittle when tried in cold water. Turn into a well-buttered pan; when slightly cool mark with a sharp-pointed knife in squares. This candy is much improved by cooking a small piece of vanilla bean with other ingredients.

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COCOANUT BAR.

Ingredients: *1 cup sugar, ¼ cup water, ⅛ teaspoonful cream of tartar, 1 oz. cocoanut.*

Stir the sugar, water, and cream of tartar together over the fire until the sugar is dissolved. As soon as bubbles are seen, cook without stirring until it threads. Remove immediately from the fire. Cool (but not in a very cold place), then beat until it begins to thicken, then add the cocoanut. Spread on a buttered pan and cool.

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FUDGE.

There are almost as many recipes as persons who make it. One rule is, two cups of sugar to one cup good rich milk. Cook, stirring constantly, until it forms a soft ball when dropped into ice water. Beat in butter the size of an egg, and beat the fudge until it begins to thicken fairly well. Pour on to a buttered tin, and, when hard enough, cut into squares.

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PEANUT CANDY.

Ingredients: *1 cup sugar, ¾ cup chopped peanuts.*

Heat the sugar in a frying pan until it melts, being very careful not to let it scorch. When the sugar is melted mix the peanuts into it thoroughly and spread on a tin or iron sheet. Either cut into bars while soft, or break after it hardens.

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TOFFEE.

Ingredients: *¾ cup brown sugar, 2 tablespoonfuls butter, 1 tablespoonful vinegar.*

Cook until it will harden when dropped in ice water, then pour on a buttered pan to cool.

Chocolate Caramels.

Ingredients: *$2\frac{1}{2}$ lb. butter, 2 cups molasses (or golden syrup), 1 cup brown sugar, $\frac{1}{2}$ cup milk, 3 squares chocolate, 1 teaspoonful vanilla.*

Put butter into saucepan and melt, then add molasses, sugar, and milk. Stir until sugar is dissolved, and, when boiling point is reached, add chocolate, stirring constantly until chocolate is melted. Boil until it will make a firm ball in cold water. Add vanilla just before taking from the fire. Turn into a buttered pan, cool, and mark into small squares.

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Fondant.

Ingredients: 1 cup sugar, $\frac{1}{8}$ cup water, $\frac{1}{10}$ teaspoonful cream of tartar.

Cook all together until it threads, then pour on a plate and beat with a fork until creamy. Add five drops of flavouring just before beating. This candy can be kneaded with the hands as soon as cool enough. It can be kept for some time if wrapped in a damp napkin.

It is the foundation of all French candies, and can be made into an almost endless variety. Shape into cones, and dip in melted chocolate to make chocolate creams; grated orange peel, chocolate, etc., may be kneaded into it; it makes a delicious filling for stuffed dates; English walnut meats, split raisins, etc., can be pressed on each side of a small piece; flavoured with peppermint oil, it makes nice cream peppermints, and so on.

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Peppermints.

Ingredients: *1 cup sugar, 4 tablespoonfuls cold water, 8 drops oil of peppermint.*

Cook the sugar and water until it threads. Be very careful not to cook it too much. Pour it into a bowl and add the flavouring. Beat until it begins to look cloudy and thickens, then drop with a teaspoon on paraffin-waxed paper. Experience will show that the candy must not be cooked too long nor stirred too long. This is delicious if successful.

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Fondant Candies.

Cream Nut Bars.—Melt fondant over hot water, stir in any kind of nut meat, cut in pieces. Turn into an oiled pan, cool, and cut in bars with a sharp knife.

Dipped Walnuts.—Melt fondant and flavour. Dip halves of walnuts as bon-bon centres are dipped. Whole blanched almonds may be similarly dipped.

* * * *

We are indebted to Miss Flora Rose, lecturer, Department of Home Economics, New York State College of Agriculture, Cornell University, U.S.A., for the following recipes for preserving green mealies for winter use. Miss Rose says she has not tried them herself, but they are in use among farmers' wives in New York State:—

Canned Maize.

Cut maize from cobs. To one quart of maize add one teaspoonful each of salt and sugar. Put maize into fruit jars and pack as closely

as possible. Adjust rubbers and set cover on loosely without sealing. Set the filled jars on a perforated board in bottom of boiler and cover to about one-third their depth with water. Cover the boiler, and steam for two hours. After one hour's steaming the contents of jars will have contracted; therefore use the contents of several jars to completely fill the others, and fill jars to overflowing with boiling water. Steam one hour longer and seal.

Fresh Canned Maize.

Pack alternate layers of maize, cut from the cobs, and salt into fruit jars and press together firmly. Cover closely and set away. Before using soak the maize in water to remove salt. This method is very simple, and is said to give satisfaction.

IV. HOUSEHOLD SCIENCE NOTES.

To renovate black cloth which has worn green and rusty boil half a pound of logwood chips with a quarter of an ounce of green copperas in three pints of water until it is reduced to a quart. Strain off the liquid as soon as it is cold, and add to it four tablespoonfuls of gin. Brush the garment well to free it from dust, sponge the shabby parts with the logwood water, and, when quite dry, brush with a soft brush.

Orange peels should be saved and dried, as they make excellent fuel. The peels should be placed in a moderate oven and left there all night, and when they are quite dry they will keep for a long time. A few chips sprinkled on a dying fire before adding more coal will help to revive it. They are invaluable as fire-lighters, and particularly in a sick room, as they burn with more heat and less noise than dry wood.

The wicks of lamps should never be cut with scissors, but rubbed till smooth and even with a piece of paper.

A feather brush is the best for removing dust from gilt picture frames; on no account use linen cloths, as they wear the gilt off and deaden its brightness.

To remove inkstains from books take a small quantity of oxalic acid diluted with water, applied with a camel-hair pencil and absorbed with blotting-paper; two applications will remove all traces of the ink.

Nasturtium seeds used as capers are quite good, if the seeds are gathered before too hard, and kept for a day or two with salt sprinkled over them; put into bottles, pour boiling vinegar over them, and cork when cool.—Miss E. Buckley.

White onion cut up finely, thickly sprinkled with sugar and allowed to remain outside over night, the syrup drained off next morning and given in small doses frequently to the patient, is excellent for whooping cough, relieving when nothing else would.—Miss E. Buckley.

Rice and other farinaceous puddings made of skimmed milk, with the addition of some very finely-shred suet, if very slowly cooked, will be equal to those made of new milk; no eggs will be required if the cooking is long and the heat very moderate.

Raisins will stone more easily if slightly warmed; and candied peel should always be placed in the oven before cutting up.

If the hands are powdered well before new gloves are put on, the gloves will slip on quite easily.

In making soup from meats put the meat on in cold water and cook slowly with the idea of extracting as much of the nutriment as possible.

If a shirt-bosom or any other article has been scorched in ironing lay it where the bright sunshine will fall directly on it, and the brown spot will disappear.

Artificial roses and flowers which have considerably faded may be dyed the most attractive shades of pale mauve and brownish-pink by dipping them in a solution of red ink and water.

When peeling onions begin at the root and peel upward, and the onions will scarcely affect the eyes at all.

When it is required that a dish or plate of food be kept hot for an hour or so a better plan than putting it in the oven is to stand it on a saucepan of boiling water.

Heat a lemon thoroughly before squeezing, and you will obtain nearly double the quantity of juice you would if it had not been heated.

RULES FOR MAKING AND BAKING CAKE.

Have the oven ready to receive the cake as soon as it is mixed. The oven can wait a few minutes for the cake; the cake can never wait for the oven. Frequently the coarseness of a cake is due to its standing a moment before going into the oven, or the oven not being at the right temperature when the cake goes in. Cakes without butter require a quick oven. Small cakes require a moderately hot oven; while cakes containing treacle require careful watching in a moderate oven, as they scorch easily. If your oven is too hot and the cake browns too quickly, stand a pan of cold water in the oven, which will reduce the heat. Never move a cake in the oven until the centre is thoroughly "set." If you jar it, it will become heavy in the centre and near the bottom. To try a cake without a thermometer, put your ear down near the pan; if the cake ticks loudly or makes a crackling sound it should be put back, as it is not yet done. If the ticking is very faint or absent, it is done. Remove cake from pan and put on a sieve to cool. A cake should not be handled too much while still hot, as it will become heavy.

When a recipe calls for many eggs a teaspoonful of baking powder or egg-powder may be used in place of two eggs.

ERRATA.

We would call our readers' attention to the following errors which occurred in Farmers' Bulletin No. 1 (third edition) on "Maize Foods for the Home," and the April, 1909, issue of the *Agricultural Journal* (No. 27):—

Farmers' Bulletin No. 1.

Page 5, line 3 from bottom, for "butter' read buttered.

Page 14, line 27 from top, for "5 minutes" read 5 hours.

Page 19, line 9 from bottom, for "drainage" read draining.

Page 21, line 26 from top, for "milk flavouring" read milk and flavouring.

Page 22, line 4 from bottom, for "butter" read batter.

Page 23, line 6 from top, for "four cups milk" read four small cups milk.

Agricultural Journal No. 27.

Page 535, line 25 from top, for "2½ plates mealie meal" read 2½ plates boer meal or wheaten flour.

Useful Facts and Figures for Farmers.

PREVENTING WASTE OF SILAGE.

(Canadian Dairyman.)

Each year, as frequently as silos are filled, there is considerable waste, owing to the surface layer coming in contact with the air. The loss varies with the condition of the maize and with the attention it has received after it is placed in the silo. In seasons of plenty it is a common practice to simply fill the silo and take chances on what would spoil. This is a very wasteful practice. It is possible to bring this waste down to a minimum by a little attention after the silo has been filled and thoroughly tramped.

Last year, owing to the scarcity of maize, we made an extra effort to preserve all that we had, as a result of which effort there was scarcely 2 inches of spoiled silage. After the silo was filled and thoroughly tramped we put a 2 inch layer of clover chaff on it. We then dampened this chaff with a barrel of water, in which had been dissolved a 10 quart pail of salt. This brine proved to be the most effective preserver we had ever tried. On the surface, when we came to feed the silage, the 2 inch layer on top peeled off slick and clean and left good silage immediately underneath. Try this scheme on your silo, and you will save much fodder that would otherwise be spoiled.

RINGING TREES.

(Journal of Agriculture of South Australia.)

Several questions have reached the Department of Agriculture lately with regard to the proper method of ringing trees which it is desired to destroy. Mr. Walter Gill, the Conservator of Forests, supplies the following information:—"The best time to ring trees is when the sap is moving freely, and though this time varies in different localities, it is usually most active in spring and early summer. In most cases if the bark strips freely the sap is well up. The time required to kill by ringing depends upon the vigour and age of the individual tree to a very large extent, and also upon the skill and judgment with which the work is done. Trees die more quickly when rung in full sap, and the time may vary from a few months to over twelve months. Cutting into the sap-wood appears to produce the most speedy results, as the leaves die in a short time because the rise of sap is prevented, but a dense mass of shoots usually grows below the cut. These shoots have to be destroyed, and they often repeat themselves. The removal of a 10 to 15 inch band of bark ultimately produces better results, as it kills the roots more quickly than the chip-ringing, and no shoots spring below the cut."

CURING HAMS AND BACON.

(Queensland Agricultural Journal.)

Before being killed, a pig should have nothing to eat for at least twelve hours preceding the slaughter. By whatever means the

animal's death is accomplished, every endeavour must be made to get the last drop of blood out of the body, otherwise the flesh will not cure well. As soon as this is done, the carcass should be plunged into boiling water. The proper temperature is very important. If either too hot or too cold, the hair will not come freely off. A good old-fashioned plan to try the temperature is to let a few drops of pig's blood fall on the water. If it spreads all over the surface, the temperature is right. Leave the pig in the water till the hair comes freely off. The next thing is to hoist the carcass out of the water, hang it up and scrape it vigorously with some sort of blunt scraper—the lid of a billy is as good as anything else. When the hair is removed, dry the carcass well. Next remove the intestines, and wipe the inside of the body dry. Let the pig hang in a cool place for twenty-four hours. Then cut it up into hams, hands, spare-ribs, loins, and belly pieces. The spare-ribs and loins are usually roasted fresh. The other parts are rubbed over with coarse salt and a little saltpetre and laid on a table, flesh uppermost, so as to drain off any blood.

Where a side is to be dry-cured whole, after removing the joint oil and washing the cavity freely with salt and water, the flesh part of the side should be sprinkled freely with equal parts of powdered saltpetre and boric acid to retain the colour. After twenty-four hours wash this mixture off. Then dry-salt with the following:—50 lbs. best fine dairy salt, 5 lbs. brown sugar, 5 lbs. powdered saltpetre, 5 lbs. boric acid. These should be well mixed and passed through a fine sieve. Rub the flesh freely every morning with this mixture for fourteen days. Each day drain off all accumulated fluids. More care should be directed to rubbing the first two days, after which it may be conducted more lightly. The sides are laid one on each other, and reversed every day.

When the curing is completed, wash off the salt, etc., with warm water and hang the side up to dry in a well-ventilated room. With favourable weather this will take from four to six days.

The bacon is then hung in the smoke-house. The fireplace is outside the smoke-house, from which a flue communicates with the centre of the floor to reduce the temperature of the smoke as much as possible before reaching the bacon. It is a distinct advantage to smoke in a cool state. Native apple tree and hardwood sawdust, or damp maize cobs, are useful to smoke with, and will improve the flavour. The smoking will take from four to five days. Judgment is needed to determine when the flavour is sufficiently developed.

TREATMENT OF "RIJST-MIEREN" AND "HOUTKAPPERS."

The following method of treatment of these insects is strongly recommended by various correspondents of the *Cape Agricultural Journal*:—

They are said to be generally most active on the afternoon of a warm day. The places where they work are watched, and while they are very busy a small quantity (as much as will go on the point of a pocket-knife) of arsenic is put into all the holes where they are working, or about a teaspoonful of *fine* Cooper's Dip may be sprinkled over the sticks, straws, etc., gathered by these termites around their

holes. It is generally found that within a few hours, or at the most a day or two, they have ceased to work, and though a few may appear again the following year, a second dose destroys them. The spreading must be done as thoroughly as possible; every hole at which they are working being treated.

Another method said to have been used successfully is to mix the arsenic thoroughly with bran or fine chaff, and then to pour over sufficient water to moisten and let it stand for a few hours. Care must be taken not to make it too watery, as it then sticks together and will not distribute nicely.

Yet another method recommended is to boil together in an old iron pot for about half an hour 1 lb. white arsenic, 3 lbs. sugar, and 3 gallons of water; stir well while boiling; when cold the mixture can be applied in the same way as the Cooper's Dip, and a quantity can be bottled when cold for use as required.

DEPTH TO PLANT POTATOES.

(Journal of Agriculture of South Australia.)

The depth at which potatoes should be planted is a matter of considerable importance to growers, and in this connection the experience of other countries is interesting. Two years ago tests were made by the Nebraska (U.S.A.) Experiment Station as to the relative advantage of different depths of planting potato sets, the depths ranging from 1 inch to 5 inches. The total yields from the tests were as follows:—

Planted 1 inch deep, 182 lbs.
Planted 2 inches deep, 188 lbs.
Planted 3 inches deep, 298 lbs.
Planted 4 inches deep, 317 lbs.
Planted 5 inches deep, 306 lbs.

The indications of this one test are, therefore, that 4 inches is about the proper depth for planting seed tubers in South Australia. The 1 inch and 2 inch depths are certainly not to be considered under ordinary conditions, since such shallow planting is not only apt to reduce the yield materially, but also to produce irregular, compound tubers.

STORING SEED POTATOES.

(The Field, the Country Gentleman's Newspaper.)

The storing of seed potatoes during the interval between digging and planting imposes a more severe tax upon the resources of the farmer than is commonly supposed. This is one of the few problems that vary in inverse ratio to the severity of the climate. Northern growers know little of the difficulties that have to be contended with by the southern farmer in a matter of this sort. The chief problem is to prevent the tubers from sprouting in clamp or pit, and, obviously, the tendency to premature growth is greater in the warmer climate. In Scotland, and in many parts of Ireland, the potatoes seldom show any signs of vitality until the spring and the planting operation is due. In England, on the other hand, in average winters fairly long shoots are common as early as January, and as these sprouts are broken intentionally or in the process of handling, it stands to reason

that the quality of the potatoes for seeding purposes is seriously impaired. It has been found that potatoes from which the first shoots have been removed do not show so vigorous a sprout a second time, and it has been suggested that the removal of the first shoot accounts to a large extent for the inferior results obtained from the use of English— as compared with Scottish and Irish—seed, and the idea is intelligible and consistent with sound reasoning.

EXTERMINATION OF RABBITS.

(*Nature*.)

In *Nature* for 21st March, 1908, was published a notice by Dr. P. L. Sclater of a pamphlet by Mr. W. Rodier on the best means of exterminating rabbits in Australia, while a second notice was communicated by Mr. W. B. Tegetmeier to the issue of 13th November, 1908. Both notices are commendatory of the plan, which consists in killing off the females and thus causing a preponderance of males, which will kill a considerable proportion of the largely diminished number of young. Mr. Rodier has published a new edition of his pamphlet, entitled "The Rabbit Pest in Australia," issued in Melbourne.

COOKING FOOD FOR PIGS.

(*Journal of Agriculture*, Western Australia.)

Ever since pig-keepers have been, there seem to have been mixed opinions concerning the value of cooking for swine; some urging it, others believing it to be a waste of time, fuel, and labour. There are two ways in which pigs may benefit from being fed with cooked food, one being the warmth of the food, which is a considerable factor in cold weather; the other being the changes brought about in the tissues of the food by cooking. We do not propose to enter into the lengthy discussions that have waxed over this contentious subject, but we may draw one or two generalisms which may be useful in guiding our farmers. It will be found that most of the English and European feeders prefer and practice cooking the food, and that the chief opponents to the system are the American feeders and experimentalists. These latter have demonstrated again and again to their own satisfaction that cooking the food does not enable the pig to make better use of it; indeed, the results have frequently shown that the pigs fed on cooked foods gave inferior returns compared with those fed on the same foods uncooked. American feeders advocate soaked grains instead of cooking, and the feeding of other usual sources of pig food in the raw state. In very cold weather food is found to be more beneficial if fed warm, because it enables the pigs to keep warm with a much lower consumption of the carbohydrates and fats. There are some feeders who believe in feeding food in process of fermentation; equal quantities of crushed grains and pulped vegetables, such as pumpkins, turnips, mangels, and the like are mixed in heaps upon the feeding-room floor until fermentation sets in well, when the mixture is fed to the animals. They claim to get the best results from the system that they can get from any. But there are plenty to swear that they get by far the best results from cooking, and as many again to make solemn affidavit that cooking pig food does not pay for fuel.

USE OF SUPERPHOSPHATE.

(The Gardeners' Chronicle.)

The use of superphosphate is increasing rapidly in the United States. Many farmers use the superphosphate alone. They are beginning to regard the so-called complete fertilizers with disfavour. They argue that there is not enough nitrogen and potash in the complete fertilizer to do much towards growing the crop. That if the soil needs potash and nitrogen there is not enough of these elements to pay extra cost of the goods. Some use superphosphate alone, others use it with potash and depend upon growing legumes to supply the nitrogen. Professor Massey tells us that the farmers in Maryland have brought their land, which grew 15 bushels per acre a few years ago, into such a condition that it now produces 40 bushels per acre, by using superphosphate alone and by growing cow peas. This shows what can be accomplished by a good rotation and the use of a cheap fertilizer. (A. J. Legg, Albion, Nicholas Co., W.Va., U.S.A.)

TO COMPARE ENGLISH AND TRANSVAAL MARKET PRICES OF MAIZE.

In the London market maize is always sold by weight, the unit being the "quarter" of 480 lbs. To convert the market quotations from quarters to muids, remember that :

24s. per quarter is equal to 10s. per muid.
36s. ,, ,, 15s. ,,
6s. ,, ,, 2s. 6d. ,,
1s. ,, ,, 5d. ,,
3d. ,, ,, 1¼d. ,,

The following table is useful for ready reference :

At per Quarter. s	d		Equals per Muid s	d.
0	1	...	0	0·4166
0	2	...	0	0·8333
0	3	...	0	1·2500 (i.e. 1¼d.)
0	4	...	0	1·6666
0	5	...	0	2·0833
0	6	...	0	2·5000 (i.e. 2½d.)
0	7	...	0	2·9166
0	8	...	0	3·3333
0	9	...	0	3·7500 (i.e. 3¾d.)
0	10	...	0	4·1666
0	11	...	0	4·5833
1	0	...	0	5·0000 (i.e. 5d.)
2	0	...	0	10
3	0	...	1	3
4	0	...	1	8
5	0	...	2	1
6	0	...	2	6
7	0	...	2	11
8	0	...	3	4
9	0	...	3	9
10	0	...	4	2
11	0	...	4	7
12	0	...	5	0
13	0	...	5	5
14	0	...	5	10
15	0	...	6	3

At per Quarter s	d		Equals per Muid s	d
16	0	...	6	8
17	0	...	7	1
18	0	...	7	6
19	0	...	7	11
20	0	...	8	4
21	0	...	8	9
22	0	...	9	2
23	0	...	9	7
24	0	...	10	0
25	0	...	10	5
26	0	...	10	10
27	0	...	11	3
28	0	...	11	8
29	0	...	12	1
30	0	...	12	6
31	0	...	12	11
32	0	...	13	4
33	0	...	13	9
34	0	...	14	2
35	0	...	14	7
36	0	...	15	0
37	0	...	15	5
38	0	...	15	10
39	0	...	16	3
40	0	...	16	8

Extracts from Exchanges.

LEGISLATION AGAINST *LEONOTIS LEONURUS* AT THE CAPE.

(*The Gardeners' Chronicle.*)

The Lion's Tail (*Leonotis leonurus*) has recently been referred to in some of our contemporaries as a plant that should be more extensively grown for autumn and winter flowering. Besides the attractive character of the plant, it may be interesting to those who grow it or intend to do so, to know that it possesses narcotic properties (notwithstanding that it belongs to the usually considered harmless order *Labiatæ*), and that its cultivation at the Cape of Good Hope, where it is a native, is a subject that recently occupied the attention of the Legislative Council, which brought in a Bill to prohibit the cultivation of this plant, as well as the Klip Dagga (*Leonotis ovata*) and the common hemp (*Cannabis sativa*), the same narcotic property being contained in all three plants. It is a well-known fact that in tropical countries the hemp plant develops a narcotic resinous coating on the leaves, stem, and flowering tops, which is used either for smoking or for infusing in water in the preparation of an intoxicating beverage. In India the gum resin is known as Churrus or Charas, and is said to be collected by men clothed in leather garments brushing about amongst the plants, and thus bruising them, so that the resin exudes and becomes attached to the clothing of the collectors. The dried flowering tops, called Gunja, are smoked, and they are sometimes to be seen in the London market, where the article is generally known as Gauza. The intoxicating effects of all these preparations of hemp are well known, and a similar principle seems to be contained in the plants of *Leonotis*, hence the action of the Cape Legislative Council, whose Bill provided that it should not be lawful for any person to sell or grow and cultivate either of the three plants before mentioned, under a fine of £25. Provision, however, is made that nothing should hinder a registered chemist and druggist from using any of these plants for medicinal purposes, under the direction of a medical practitioner. It is provided also that licences should be obtainable from a minister by any one intending to cultivate the plants for purely medicinal purposes. The reasons for the necessity of legislative restrictions were stated to be that the habit of smoking the plants by the natives caused them to become indolent and stupid, resulting in insanity and consequent confinement in lunatic asylums and prisons. In India similar effects are produced by the continued use of hemp—exhilaration at first, followed by great depression, but often with "wild reveries and causeless laughter." Long continued use is said to be a prominent cause of insanity. In some parts of India an excise licence is required to cultivate the plant.

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LUCERNE PASTURE FOR FATTENING PIGS.

(*Journal of Agriculture* of South Australia).

Throughout the hog-raising States of America lucerne is highly valued, not only for feeding young and store pigs, but also as a part of the ration for fattening. In a recent bulletin issued by the Nebraska Agricultural Experiment Station, some interesting experiments in this direction with pure and grade Duroc-Jersey pigs are recorded. In one

experiment with twenty brood sows, from which the pigs had been weaned, a comparison was made between the results obtained by feeding maize in a dry lot, and maize with a five-acre paddock of lucerne. In each lot there were ten pigs, and these were fed for thirty days. The one lot received daily 4 lbs. maize for each 100 lbs. live weight of the pigs; the other 3 lbs. per day and the run of the lucerne paddock. The average gain in weight per pig in the thirty days was 73 lbs. in the maize lot and 79 lbs. in the maize and lucerne. The pigs on lucerne pasture gained 6 lbs. more in the thirty days, and ate 130 lbs. less of maize for each 100 lbs. gain in weight than did the other lot; while the average profit on each pig, after allowing for the value of the lucerne pasture, was 81 cents more in this lot. Looking at the results in another way, the figures show that for each bushel of maize fed to the pigs on lucerne, the return was 1.02 dollars; while in the dry lot the return was only 71 cents—a difference of 31 cents (about 1s. 3d.) per bushel in favour of the lucerne-pastured pigs. To produce 100 lbs. of gain it took 43 per cent. more corn in the dry lot than in the pasture lot. In a further experiment with barley it was found that the results from the feeding of barley and lucerne, as compared with barley alone, were in line with the former experiment, though the gain was not quite so much in favour of the lucerne-fed pigs. The grain in these tests was ground and fed wet. The general conclusion of a number of experiments was that lucerne may be fed with profit to either growing or fattening pigs in almost any form, so long as it does not make up too large a proportion of the ration. When cut and fed as one-quarter of the ration, with ground maize, it materially reduced the cost of grain and increased the profits.

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THE IMPROVEMENT OF CROPS BY BREEDING AND SEED SELECTION.

(A. D. Shamel in the United States Department of Agriculture Year-Book.)

There are at least two distinct lines of work in the improvement of crops by breeding and seed selection—(1) the art of breeding, and (2) the science of breeding. The results of scientific investigation are of great importance to the breeder, but the methods of scientific investigation are not always applicable as methods of breeding. The great field for the breeder's art lies in the improvement of existing varieties of crops and their adaptation to local conditions of soil and climate. Another but less important work is the production of new varieties adapted to new agricultural conditions. The breeder should have a natural adaptability for his work, and the value of his work will depend largely on his expert knowledge of the varieties of crops to which he directs his efforts. The work of breeding and the results, at least so far as the distribution of the seed is concerned, can be most effectively done by organised effort.

* * * *

THE MAIZE-BREEDING WORK OF THE AMERICAN EXPERIMENT STATIONS.

(Year-Book of the United States Department of Agriculture, 1906.)

The yield of maize for the whole of the United States has trebled during the last 40 years. This is mainly due to increased acreage, but is partly due to improvement in the maize plant itself by breeding.

We have seen how artificial pollination may be employed in maize improvement, but it remains very evident that it is really only a small

factor when compared with selection, upon which the great and general progress in maize breeding must be based, because crossing without subsequent selection can accomplish but little, and for the further reason that selection is the more generally applicable of the two means. The farmer is already familiar with selection along a certain line, and only a wider application of the principle is necessary. The endeavour of the experiment station and the agricultural college is to teach him how to apply it scientifically and practically, not only with reference to the ear, but also with reference to the kernel, the entire plant, and even the row.

Experiment station work has brought about a marked change in the methods of selection. As already pointed out, the original method consisted in basing the selection upon the type of ear, and great progress in the improvement of maize has been thus accomplished, but experiments conducted by many stations have shown that even carefully selected seed ears, alike to all outward appearances, may still have a wide variation in yielding capacity, amounting to even more than 100 per cent. In fact, at the Nebraska station 10 seed ears compared for this purpose ranged in yield from 35.6 to 81.6 bushels, or a difference of 46 bushels per acre. The Wisconsin station in a recent test found the yields of different ears of Silver King maize to vary from 14 to 97 bushels of shelled maize per acre, and the yields of select seed ears from 1½ pounds to 56 pounds per ear of seed maize. The difference in productiveness is not revealed by an examination of the ears, but must be ascertained by actual test, so that the yields may be measured. This indeterminable factor is called the individuality, and is analogous to the individuality in animals, which also shows itself in the progeny.

As in the development of the breeding plat, selection has gone through various stages. In some of the earlier work with maize the station efforts were largely directed toward testing and comparing varieties for the purpose of singling out those best suited to certain localities and conditions. This was selection applied to the variety as a whole, and as a typical instance some of the work of the Minnesota station may be cited. This station made a selection of varieties grown in the State and compared them. This collection was regarded as a foundation stock from which the best variety was to be selected. The varietal names, if any such existed, were disregarded, and the samples received were simply indicated by a serial number. Of these varieties and strains No. 13 proved most promising, the distinguishing character being a high yielding capacity. The variety was tested for several years, and selected according to scientific principles, and then disseminated under the name of Minnesota No. 13. At present it is grown quite extensively in southern Minnesota, and it has also been distributed in South Dakota by the experiment station of that State. The Wisconsin station has selected a strain of this variety, known as Wisconsin No. 8, the seed having been secured from the Minnesota experiment station, and has used the same as the male parent in breeding for earlier maturity in some of the late heavy yielding varieties of yellow dent maize in order to make them better suited to Wisconsin conditions. While this line of work is of the greatest value and must be carried on continuously, selection has been introduced to a much greater extent in procuring seed either for the improvement of the variety itself or for the maintenance of its desirable characters.

Formerly in seed-maize selection only the type of ear was considered, but it is now widely recognised, and the stations are continually dwelling upon the point, that this is not enough, but that selection must be applied

to the individual plant and to the individual ear with reference to its productiveness. As shown by station work, it is the performance record rather than any particular point about the ear that forms a definite basis for the selection of its progeny for seed. Even the size of the ear, which undoubtedly was regarded as one of the principal and desirable features, and probably in most cases determined the selection of seed, cannot be relied upon as indicating the best yielding qualities. In experiments to determine the relation of size of ear to yield the Nebraska station found that the average weight per ear of the five highest yielding varieties under test was 0.705 pound, while the average weight per ear for all the varieties was much higher. In some cases large-eared varieties were rather low in yield, thus indicating that no definite relation between the size of the ear and the yielding capacity exists. It was further brought out by co-operative tests that the size of the yield varies with locality, and is dependent upon soil, climate, and elevation, and the data secured showed plainly that for western and central Nebraska a smaller-eared type of maize should be selected than for the eastern portion of the State.

The effect and value of careful selection in maize-growing are shown by the results of numerous other experiments, and are especially and more definitely thrown into relief by co-operative work. In work of this kind by the Wisconsin Experiment Association in 1905 with Silver King maize, a variety which had undergone selection at the station for several years, an average yield of 59.2 bushels per acre was secured, while the best of all other varieties observed, not so long and carefully selected, in the comparison yielded on an average 10 bushels less.

At the Wisconsin experiment station the results of maize breeding in accordance with the plat system show an increase in the proportions and average yields of seed maize and marketable maize in the crops produced. In 1905 each row in the breeding plat produced on an average 22.6 pounds of seed maize, 97 pounds of marketable maize, and 7.2 pounds of nubbins; and in 1906, 53.1 pounds of seed maize, 132.8 pounds of marketable maize, and 13 pounds of nubbins. The average yield per acre of the plats in 1906 was at the rate of approximately 75 bushels per acre. The increase in yield was in some instances largely due to soil and season, but the increase in seed maize was greater in proportion than that of the nubbins, thus indicating that a constant selection from the breeding plat will materially increase productiveness and quality. An experiment was also made to determine to what extent the bearing qualities of different stalks would be transmitted to the progeny. Seed maize was selected from stalks bearing a single large ear and from stalks bearing two ears. A greater total yield was secured where the selection was made to increase the number of single ears in the plat than where it was made to increase the number of double ears. Where two ears were borne on a stalk generally one or both were small and poorly formed.

The Rhode Island station has pursued for several years a somewhat similar line of work with sweet maize by selecting the upper and lower ear of stalks producing the largest number of ears. This was done to ascertain whether the lower ear would increase lower ear production, together with the number of ears on the stalk, as compared with seed from the upper ear. In 1901 35 per cent. of the plants bore more than one ear, and in 1905 90 per cent. bore more than one ear, the highest number of ears from a single plant being 13. Although the earlier results seemed to show that the character or the individuality of the maize plant from which the seed

is taken is of much greater importance in maize breeding than the position of the ear on the stalk, it was found that selecting seed from the lower ear was not so satisfactory as selecting it from the upper ear.

HARVESTING MAIZE.

(*Farmers' Cyclopedia of Agriculture.*)

Numerous experiments have shown that the dry matter in the maize plant increases as maturity approaches, and that, therefore, whether the crop is grown for grain, fodder, or silage, much will be lost by too early cutting. On the other hand, stalks allowed to stand in the field after ripening lose considerable dry matter. At the Iowa Station this loss, two months after ripening, under ordinary field conditions, amounted to about one-half of the dry matter and more than one-half of the total feeding value. According to the same authority "the stover of a crop of maize seems to reach the highest yield and the best condition for feeding at the stage of growth indicated by a well-dented kernel and the first drying of the blades. The grain of a crop of maize seems to reach the highest yield and the best condition for utility at the stage of growth indicated by a well-ripened ear and a few dry blades: and the best time for securing the crop with reference to the highest utility of both maize and stover would be found at a stage of ripening between the above."

At the Kansas Station maize cut in the milk stage yielded 35.5 bushels of grain and 2.4 tons of fodder per acre; in the dough, 51 bushels of grain and 2.4 tons of fodder; when ripe, 74 bushels* of grain and 2.7 tons of fodder. These results agreed with those of previous experiments. They have been in the main confirmed by similar experiments at the Illinois, Minnesota, New York, New Hampshire, and Pennsylvania Stations. The Wisconsin Station recommends the cutting of flint varieties for silage when just past glazing, and dent varieties when "well dented"; while the Vermont Station recommends that maize be allowed to stand before ripening as long as it is safe from frost. The Ohio Station found there was little difference in the yield of grain between maize cut and shocked, provided it was sufficiently matured at cutting time, and that left standing.

In the field-curing of maize at the Colorado Station, large shocks lost 31 per cent. of their dry matter. small shocks 43, and maize spread on the ground 55 per cent., largely caused by the active fermentation in the seemingly dry and well-cured stalks. At the Oklahoma Station the outside stalks of maize shocks exposed to the sun, rain, and wind lost fully one-fourth of their feeding value as compared with the inner stalks. The average loss in dry matter at the Wisconsin Station in ensiling maize was 15.6 per cent. and in field-curing the same fodder 23.8 per cent.

To sum up, harvest maize for both grain and stover soon after the kernels are well dented and the blades begin to dry, but before the ears are thoroughly ripened. For silage, harvest flint varieties when just past glazing and dent varieties when well dented.

* 74 bushels = 20·72 muids.

MAIZE STANDARDIZATION IN AMERICA.

In his Annual Report for 1907 the United States Secretary of Agriculture refers to the unsatisfactory methods of handling and grading grain then in vogue in the United States, and to the efforts of the Federal Department to remedy the defect. Laboratories have been established at six of the most important centres, at which the various problems connected with standardizing methods and grades are being thoroughly investigated.

A new moisture-testing apparatus has been perfected and introduced by the department, and has been used with great success in these laboratories. This apparatus has been adopted by many commercial organisations, and they report that it has been of the greatest value to them in determining the moisture content of the grain. This apparatus enables one to determine the moisture quickly and accurately, making it entirely practicable for use under commercial conditions.

The Secretary notes that it becomes more and more evident as this work progresses that some uniform system of inspecting and grading grain is absolutely imperative. American producers of grain, he states, suffer through lack of uniformity in grading, and their markets abroad are injured by lack of confidence in the grades established. He believes that the end to be attained is through *National* inspection of all grain entering into inter-state and foreign commerce.

IMPORTANCE OF GOOD SEED.

Cheap seed is often the most expensive thing connected with a crop. A few pence saved on each pound of lucerne seed may cost the farmer all of his work in preparing and fertilising the ground, besides the loss of an entire season in getting the crop started. Actual field demonstrations have shown that, taking maize in the average—that is, maize from different parts of the country as ordinarily saved for seed by farmers—*the yield would be increased about 15 per cent.* if the *vitality were perfect.*—JAMES WILSON, Secretary of Agriculture, Washington, U.S.A.

ACETYLENE GAS REFUSE AS A MANURE.

(*The Gardeners' Chronicle.*)

In recent years the use of acetylene gas for lighting purposes in country houses has greatly increased. The generator is usually situated in the garden, and therefore the gardener is required to look after it. Acetylene generators yield a large quantity of refuse, and, judging from the enquiries which from time to time are addressed to us as to the manurial value of this waste material, there seems to be considerable doubt as to its composition. The fact that it is composed almost entirely of slaked lime has led to its being regarded as of equal value to lime for use as a manure. That it is not quite the same as lime is obvious to the senses both of the eyes and nose. These differences are due to the presence of small quantities of impurities in the original calcium carbide used in the preparation of the gas. The impurities may greatly reduce the value of the refuse for manure, and even make it positively injurious to plant life. The following experiments, carried out at the Wye Experimental College, seem to indicate that this is the case. In the first place an experiment was conducted as follows:—

Twelve 5-inch pots were filled with soil containing a large proportion of leaf-mould. The pots were divided up into six lots, each lot containing

two pots. To the soil of one of the lots 1 per cent. by weight of the dry, powdered refuse was added, and thoroughly mixed with the soil. Four more of the lots treated received 10 per cent., 20 per cent., 30 per cent., and 50 per cent. of the refuse respectively. The sixth lot received none, and therefore it acted as a check or control.

In each pot eight mustard seeds were sown, the pots being stood in a cool house.

After fourteen days the pots presented the following appearance :—

In the pot in which no refuse was used, and also in that which contained 1 per cent., all the seeds had germinated, and sixteen well-developed seedlings were showing.

In that to which 10 per cent. was added only two seedlings had appeared. They were both small. In the other three lots no seeds had germinated.

After fifteen days one plant had died in the pots containing 1 per cent., one more seedling had appeared in the pots with 10 per cent., and one in those containing 20 per cent.

The plants were now distributed as follows :—The control pots had sixteen seedlings. The pots containing 1 per cent. of refuse, fifteen seedlings, slightly smaller than those in the control pots. In the pots containing 10 per cent. there were three seedlings, in those containing 20 per cent. one seedling, and in those with 30 per cent. and 50 per cent. there were no seedlings.

On the 17th day the condition of affairs had altered as follows :—In the control pots sixteen plants showed the rough leaf, in the pots containing 1 per cent. of refuse there were thirteen plants showing rough leaf and one weakly seedling ; in those containing 10 per cent. there were three seedlings, whilst there were none at all in the other pots.

On the 21st day the experiment was stopped, as it was thought that no further germination would take place. At this stage only lots known as 0 per cent., 1 per cent., and 10 per cent. contained plants. There were sixteen plants in lot 0 per cent. and thirteen in lot 1 per cent. The plants were equal in size and appeared equally healthy. In lot 10 per cent. there were only three seedlings of small size, none of them showing rough leaf.

These experiments are not extensive enough to base any conclusion upon, but they indicate that carbide refuse has a marked effect on germination. This process is almost entirely stopped where 20 per cent. is present in the soil, greatly lessened and retarded with 10 per cent., and slightly so even with only 1 per cent.

The seedlings which died showed a shrivelling of the hypocotyl close to the soil, closely resembling damping off, but the fungus which causes this disease was not present.

It was now desired to see if the refuse had a bad effect on older plants. For this purpose mustard plants showing two rough leaves were used. The same pots were used as in the experiment already described.

All the plants were removed from the pots except that three plants were left in one each of the pots of lots 0 per cent., 1 per cent., and two in one of the 10 per cent.

In one each of the vacant pots of all the lots, three of the mustard plants were planted. The arrangement was now as follows :—

Lot 0 per cent. contained one pot with three transplanted plants and one pot with three of the original plants. Lot 1 per cent. was the same as 0 per cent. Lot 10 per cent. was the same, except that there were only two original plants. Lots 20 per cent., 30 per cent., and 50 per cent.

each contained one pot with three transplanted plants. On the third day the condition of the plants was as follows :—Those in lots 20 per cent., 30 per cent., and 50 per cent. had all shrivelled at the base of the stem, fallen over and died. In the other lots all the plants were growing.

On the 15th day the plants in lot 0 per cent. were all healthy. The average height in both pots was about 7 inches. Lot 1 per cent. was similar, except that the average height of the plants was only about 5 inches. Lot 10 per cent. by this time was showing the effect of the refuse. In the transplanted pot there were three plants about 2 inches high. Unlike the plants in the preceding lots, their cotyledons had entirely withered. In the original pot the two plants still survived. They were about 1½ inches high and carried very dark green leaves.

The final observations were made on the 35th day :—In lot 0 per cent. the plants were in full flower. The average height was 22 inches, the transplanted plants being a little the smaller. Those in lot 1 per cent. were similar to the 0 per cent. plants, but were smaller, the transplanted plants having an average height of 20 inches, whilst the original ones measured 17 inches.

The plants of lot 10 per cent. were not in flower, and were considerably smaller. The three transplanted plants ranged in height between 10 and 5 inches, whilst in the original pot the two plants were only 6 inches and 2 inches high respectively.

From this experiment it is seen that the amount of growth was inversely proportional to the amount of carbide refuse present. Even 1 per cent. had a bad effect, whilst 20 per cent. completely prohibited growth.

From this it appears that care should be exercised in the use of the material as a manure. We do not know if any definite cultural experiments have been made in the garden, but the refuse has been applied to various garden crops during the last five years and no marked improvement of the crop has been noticed, although the soil was one which should respond to lime—being sandy and heavily dunged. In some cases bad results have followed its use. On two occasions strawberries have failed badly after treatment with the refuse.

Until further experiments have been carried out cultivators are recommended to use great caution.

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ACETYLENE GAS REFUSE AS AN INSECTICIDE.

(*The Gardeners' Chronicle*, 8th May, 1909.)

We have found that a thin layer of this material placed over the ground will rid it of wireworm and other harmful grubs. I have not ascertained if it has killed the wireworm, but they have left the ground where it was put on. It is best applied to vacant land, where it should be dug in, and no plant should be placed on the land for at least two months after the gas lime is applied. The best time for the application is autumn or spring. Do not put it on fresh from the generator when wet, but in some out-of-the-way corner of the garden, where it can stay until it is well drained and nearly dry. I do not advocate using it on the same plot of land every year, once in three or five years being sufficient. We have used it for the following crops :—Potatoes, peas, beans, celery, spinach, carrots, parsnips, turnips, broccoli, cabbage, and brussel sprouts. We have also used it as a dressing for new plantations of strawberries. In all cases it has benefited the crop. I may repeat, however, that it must not be used

in a fresh condition. I saw a tennis court marked out with it in the ordinary way as with whitening. It killed all the grass it touched, and the turf never recovered. Grass land would, no doubt, be benefited by its application if used in conjunction with double its quantity of soil or wood ashes, and spread evenly after it has been exposed to the air for some time. This refuse forms a suitable whitewash for outbuildings or walls, applied in the same manner as lime wash.—F. R. Staddon.

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THE PROPAGATION AND DISTRIBUTION OF NEW AND IMPROVED VARIETIES OF FARM CROPS.

(A. D. SHAMEL in U.S.D.A. Year-Book for 1907.)

The difficulty in securing reliable and pure seed of the variety of crop desired, has been the chief barrier in the way of the more extensive use of improved seed by farmers. This is especially true with regard to varieties of maize, cotton, tobacco, and other general farm crops subject to cross-fertilization. The production of seed crops free from cross-fertilization with other varieties necessitates the growing of these crops in isolated fields or protecting the fields in some manner from the pollen of other varieties grown in adjoining fields. In addition to cross-pollination from different varieties the seed ears should be protected from pollination by inferior plants in the same field. This can be done by detasseling the inferior maize plants before the pollen falls, pulling out the inferior plants before they bloom in the seed-cotton fields, and covering the seed heads of tobacco seed plants with light but strong paper bags before the blossoms open. In the case of wheat, oats, rye, and other self-fertilized crops there is no danger of crossing, but there is danger in mixing the improved seed with other or inferior seed in thrashing or handling the crops. Cotton seed is usually taken by the grower direct from the gin, and may contain a considerable amount of seed left over from previous ginnings of other varieties. The breeder and distributor of improved seed must adopt the best precautions available, such as the use of seed separators and cleaners, so that the seed sent to growers will be unmixed and true to type.

It is not probable that all maize growers, for example, can arrange to grow seed free from crossing with neighbouring varieties or that all cotton growers can protect their seed fields fully from other varieties, and in this fact lies the commercial opportunity of the seed breeder. The supplying of uniform and pure seed to the growers who do not have the opportunity or conditions for keeping their varieties free from crossing, and who must of necessity go to the breeder for fresh seed frequently, is the most important and profitable field for the work of the breeder.

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BENEFICIAL FUNGI.

(*The Field*, the Country Gentleman's Newspaper.)

From time immemorial fungi have been looked upon with suspicion. In olden times, probably on account of their quaint forms, peculiar colouring, and peculiar haunts, they were associated with witchcraft and dark doings, and it was the bounden duty of every devout man to destroy all specimens encountered. A relic of this idea still remains; practically every one feels unconsciously impelled to kick over a toadstool, even at some inconvenience to himself. The kick has become automatic, the primary impulse forgotten. In modern times the connection of fungi

with plant diseases has not added to their reputation, when it is remembered that at a fairly low estimate £250,000,000 sterling is lost annually through injury by fungi to cultivated plants throughout the world. Much of this loss could be prevented at comparatively little cost if the full significance of the subject were more generally understood and the loss fully realised. At present the cultivator as a rule does not realise a loss of anything, say, below 4 per cent.; yet it is this comparatively small loss that makes up the £250,000,000, and at the same time enables the fungi to hold their own from year to year undisturbed. The time to combat fungus pests is when they are present in least abundance, and causing the 4 per cent. amount of damage, and not when an epidemic is rampant, and the loss amounts to 100 per cent. This, however, is a subject that requires much consideration, and, furthermore, is not the primary object of this note, which is intended to prove that the fungi possess some redeeming features, as judged from the standpoint of humanity.

Myriads of insects are annually destroyed by parasitic fungi. Perhaps the most familiar instance of this is the anchoring of the common house fly to a window pane by a fungus that kills it and feeds upon its substance, the threads of the fungus forming a halo on the glass round its victim. There is one group of fungi called *Cordyceps*, that live as parasites on the larvae or chrysalis stage of insects. The spores of the fungus are either swallowed along with food by the caterpillar, or find their way into its body through certain openings connected with respiration. For some time the caterpillar continues to live, apparently oblivious of the presence of the fungus in its interior. Eventually, however, the fungus saps the juices of its host and kills it when it produces its club-shaped fruit, which projects from the body of the dead caterpillar. This type of fungus is met with in every part of the world, and must be responsible for the death of innumerable insects. Some of these fungi are of considerable size, and have attracted the attention of man from remote times.

One fungus of this nature, met with in China, on account of the unusual combination of plant and animal appealed to the Celestials, who surrounded it with mystery and healing powers, and restricted its use to personages of high standing. In the majority of instances a certain kind of fungus confines its attacks to one particular kind of insect, or to a few closely related kinds. Such is the case with the cockchafer, the grub of which is a great scourge to agriculture in France. The fungus in this instance is a small white mould, which in a state of nature kills large numbers of grubs, and for some time past this fungus has been artificially cultivated and sold in a form which, when sprayed over infested land, infects and kills the grubs. Attempts have been made in other directions to cultivate on a large scale fungi that are known to be parasitic upon insects injurious to fruit trees, etc. Success has not always come up to expectations; however, the subject is only in the tentative stage, and more satisfactory methods may be discovered.

In some instances the attacks of fungi on insects are not desirable from the human standpoint, as in the case of serious epidemics that periodically befall the silkworm, and the "foul brood" of bees, caused by a bacterium an ally of the fungi.

Correspondence.

This column will be devoted to correspondence, and an endeavour made to reply to all enquiries upon agricultural topics of general interest, or concerning any of the articles published from time to time in the *Journal*.

Correspondents will kindly write on one side of the paper only. No manuscript will be returned.

All letters must be addressed to the Editor of the *Agricultural Journal*, Department of Agriculture, Pretoria.

DISEASE OF THE FROG IN DONKEYS.

Would you kindly inform me what is the best remedy to use in the case of disease of the frog in donkeys? I have one diseased in both fore-hoofs. The disease shows itself by a white exudation from the bottom of the hoof, having an offensive smell.—P. B. CARLISLE, Doornboom.

Answer.—You will find that two or three applications of a little powdered calomel, which you can obtain from the Chief Chemist of this Department, to the cleft of the frog after cleaning the hoof thoroughly, will effectually check the discharge. The best way to apply it is to work the powder into the cleft and put a little tow in on the top of it to keep it in.—C. E. GRAY, Principal Veterinary Surgeon.

INFLAMMATION OF THE HIND LEGS OF CATTLE.

We have had some slight trouble with a few of our cattle through the wet and are anxious to know certain particulars. It is soreness and inflammation of the hind legs. It first of all started with the hind oxen of the span whilst working after spells of wet weather. It was not long before other oxen got it and also some of the heifers, about fourteen in all, and in a couple of cases it travelled right up the leg. We have therefore been wondering if it can be communicated in any way, and would be glad to know if we are using the best cure, namely, "Bell's wagon grease"; it seems to do a great deal of good in most cases. The front legs never appear to be affected.—McEWAN & SUGDEN, Machadodorp.

Answer.—I have never observed the condition described by you, but should imagine it is the result of an inflammation of the skin set up by working the animals in wet weather as you suggest.

In some cases of this description a cooling lotion answers better than an oily application; in others, however, oily applications are best. If you wish to try a lotion try the following:—Place one and a half ounces of sugar of lead in a whisky bottleful of warm water, and when thoroughly dissolved add the same quantity of sulphate of zinc; when this is done a white precipitate will fall to the bottom of the bottle. The contents should be shaken up before use and the lotion applied with a soft cloth.

On the other hand, if an oily preparation answers best, mix two ounces of boracic acid in a pound of fresh lard and apply once a day.—C. E. GRAY, Principal Veterinary Surgeon.

LIME AND SALT LICK FOR STOCK.

I should be very much obliged if you could give me any information on the following subject. Up till now I have been in the habit of giving my cattle and calves "bone meal" with salt as a lick. I wish now to substitute lime for the bone meal. In what proportion should lime and salt be given to calves, young cattle, and full-grown cattle respectively? Will ordinary building lime do? Which is best for cattle, "bone meal" or lime? Lastly, how often should this lick be given?—A. MIDDLETON, P.O. Davel.

Answer.—The proportions of lime and salt for a lick are one part of lime to ten parts of salt. Use powdered slaked lime. The lick should be placed in tins or boxes where the stock can get to it. When all the lick has been partaken of, allow a month to elapse and then give another supply. Sufficient to last, say, a fortnight should be placed in the tins at one time.

As to which is the better, lime or bone meal, all depends on the character of the soil on which the animals are grazing. If it is deficient in lime constituents, use the lime lick; if there is plenty of lime in the soil, use the bone meal lick. Bone meal can, of course, be added to the salt and lime lick; use the same quantity of bone meal as of lime.

Only sterilised bone meal should be used for stock. Any other sort is liable to transmit disease, particularly anthrax.—J. M. CHRISTY, Assistant Principal Veterinary Surgeon.

BLUE-TONGUE: PREVENTION AND CURE.

I find that out of my flock of three hundred merinos I have lost thirty-five from blue-tongue, and there are several more sick. Might I ask you if there is really a cure for it, or has it got to run its course? Any advice you can give me on the subject will be most welcome.—A. CAMPBELL, New Rietfontein Mines.

Answer.—As a general rule treatment is not of much use once a sheep has developed an attack of blue-tongue. You might try ten grain doses of quinine as a powder on the tongue, three times a day, and, at the same time, give the animal a tablespoonful of whisky twice a day as a drench in a teacupful of milk.

We have had good results from preventive vaccination, and I would recommend you to adopt that procedure with your sheep. By applying to the Government Veterinary Bacteriologist, Box 593, Pretoria, you can obtain a supply of vaccine and instructions how to use it, at a cost of one penny per dose.

The blue-tongue season is now almost over; the proper time to vaccinate sheep for blue-tongue is during January and February. Ewes heavy in lamb should not be vaccinated.—J. M. CHRISTY, Assistant Principal Veterinary Surgeon.

INTESTINAL PARASITES IN SHEEP.

The following reply was sent to Mr. G. Kleyn, P.O. Maquassi Station, regarding the above subject:—

"Your sheep are evidently suffering from two distinct kinds of worms, probably the wire worm and the nodular worm (knopjes worm).

"The eggs of these worms are passed out of the bodies of infected sheep, in the faeces, and gain entrance to the alimentary canal of healthy sheep by their drinking stagnant water, grazing over low-lying marshy land, and in dirty kraals by sucking at their wool and biting themselves when soiled by excreta from the kraals. Therefore, as a preventive, see that the water supply is pure and not contaminated with the droppings of infected sheep. It may be necessary to erect drinking troughs. Do not allow the sheep to graze over wet, marshy lands (vleis) contaminated with the droppings of infected sheep, and see that the kraals are kept as clean as possible. Remove the manure occasionally and use it on your agricultural ground.

"I enclose Leaflet No. 6 which gives directions for treating sheep affected with wire worms. The same treatment will do for the nodular worms.

"Our experience is that the blue-stone treatment, when properly carried out, gives the best results. On a worm-infected farm you should not wait until sheep begin to die to start treating them. Better dose all your sheep twice a year with the blue-stone solution as recommended by us. The best time to give the blue-stone is in September and March. You may not have much success the first year, but with the blue-stone and attention to the water supply and other points mentioned earlier in this letter you should in a few years be able to entirely eradicate internal worms from your sheep."—J. M. Christy, Assistant Principal Veterinary Surgeon.

RAMIE FIBRE MACHINERY.

The Director of the Imperial Institute informs me that he believes that a ramie decorticating machine has been used by your Department. He further suggests that I should write you asking for detailed information of the results obtained with it.

If you can furnish me with this information I shall be grateful. We are considering the question of obtaining such a machine, but, before doing so, should be glad to know what you think of it, as so many machines for this purpose have been placed on the market and have proved unsatisfactory. I should specially like to know whether you consider that it would be worth while for us to invest the necessary £60 odd on this particular machine for the treatment of experimental lots of this fibre. Any further information on the subject will be gratefully received.—C. E. Gray, Acting Director of Agriculture, Pretoria.

Answer.—The ramie decorticating machine referred to in your letter of the 26th October was given a trial by this Department but did not prove a success, in fact, owing to our being unable to obtain any satisfactory decorticating machinery, ramie growing has been given up in this Protectorate for the present.

I may state, however, that a few days ago I received a letter and pamphlet from a Monsieur M. M. Michel, of Paris, 10 Rue Roden, from which it would appear that a suitable machine has now been placed on the market by him. We have forwarded Monsieur M. M. Michel's letter and pamphlet to the Director of the Imperial Institute, London, with the request to make full enquiries to ascertain if the machine is actually what it is stated to be.—L. CARPENTER, for Director of Agriculture, Nairobi, B.E.A.

GIANT KNOTWEED (*POLYGONUM SACHALINENSE*).

I take the following from "Select Extra-Tropical Plants," by Baron Ferd. van Mueller, Government Botanist for Victoria, and should be glad to hear from you as to whether you know anything of this perennial herb; if so, whether you can give me any idea as to where I could obtain seed of same? If half the advantages claimed for the plant prove to be correct it appears to me a most valuable crop, and one well worth a trial.—A. W. ST. LEGER, Hamanruka, Krabbefontein, via Pietersburg.

"Islands of Sachalien and Yesso, giant knotweed; in Bengal known as 'Mashute,' according to the *Indian Agriculturist*. This spacious perennial herb has latterly been recommended as a fodder plant, particularly by M. Doumet Adanson and Professor Duchartre. In the first year one or two cuts are obtained; in the second year three or four cuts. It may reach a height of ten feet in three weeks (Louis Haase). Numerous annual shoots arise from one root-stock. The leaves attain 1 foot in length and 9 inches in width. The edible root-stock gets finally as thick as a man's arm, sustaining the plant in its green freshness during the driest season. It will live in a temperature from $-22°$ F. to $+104°$ F. Horses are particularly fond of the foliage, which also serves for packing and displaying fruit. The plant is eligible for scenic culture, and is further a good bee plant, flowering at the end of the summer. Commissioner Marsden says that the points in its favour are:—Once planted, stands for ever. Water will not drown it; fire will not destroy it. Endures severest drought with impunity. Roots penetrate deep into the soil. Requires no ploughing before planting. Needs no cultivation. Grows where no other forage plant will exist. Grows in poorest soils. Is more nutritious than clover or alfalfa. Affords shade to cattle in hot climates. Stems and leaves, green or dry, greatly relished by cattle. Birds feed on the seeds of any polygonum."

Answer.—These statements are very much exaggerated, especially that quoted from Mr. Marsden. On the strength of similar representations, the plant was extensively tried in France and in California and other parts of the United States, but in no case—to my knowledge—has it proved other than very disappointing. Lucerne is infinitely superior, and even the prickly pear is superior in some respects. In the many places where it has been tried I do not think any one is growing it commercially.—J. BURTT-DAVY, Government Agrostologist and Botanist.

THE MAEROOLA TREE (*SCLEROCARYA CAFFRA*).

It has occurred to me that the extraordinary yield of fruit given by one single maeroola tree might be of interest to your Botanical Section. The tree in question is one growing on the roadside in Halder Street, Barberton, and has been under my own personal observation since the year 1886, at which period it appeared to be full grown.

In the year 1908 I gathered sixteen 4-gallon bucketsful of fruit which I estimate contained 700 fruit to the bucket, thus giving a yield of 11,000 to 12,000 maeroola plums. The present season's crop, 1909, I had personally collected, and counted between 9,000 and 10,000 fruit from the same tree, which, at the time of my leaving Barberton on 7th February, had still a large number of fruit to fall and be added to this enormous crop. There are several of the male trees in the near neighbourhood which yield comparatively few fruits. I am informed by Mr. MacPherson, of Mac Vale Farm, Barberton, that his wife makes a very palatable table jelly from these maeroola fruit. I have, however, had no experience of testing its qualities as a preserved fruit. The tree in question is one of the natural bush trees of the Barberton District.—WM. WAYNE, P.O. Mayville, Berea, Durban.

COMPOSITION OF SOOT.

Will you kindly inform me of the approximate analysis of soot from a kitchen stove where three-quarters of the fuel consumed is wood and one-quarter coal? The reason I ask you this is that I have been sowing lucerne seed in rows on new ground broken up last year—the land is rather poor grey soil, gritty, with small granite chips. I may mention that my farm is in the granite belt about ten miles from the Swazi border. Just as I was preparing the ground some soot was dumped down on one spot, and the lucerne on this spot is far and away the best I have—the lucerne being a nice dark green colour and three times the length of the rest. The lucerne was inoculated with nitro-bacterine and sown in the rows with super-phosphates. If soot is what the soil requires, or at all events contains some necessary chemicals, one would be all the better for knowing for future experiments.—J. M. FORBES, Lake Chrissie.

Answer.—Ordinary soot consists chiefly of carbon which has no value as a fertilizer. It generally contains, in addition, however, a small quantity of nitrogen chiefly in the form of ammonia salts. The percentage of nitrogen may vary from very little up to 4 per cent., the average being 2 per cent. Soot has also a considerable value as an insecticide (insect destroyer). From what you describe I should say that the beneficial effect in your case is due to the nitrogen the soot contains, and this would indicate that inoculation with nitro-bacterine has been a failure in your case as in most others. For if the roots of the lucerne were properly provided with nodules the plants should get all the nitrogen they require from the air. I may mention that the chief commercial fertilizers containing nitrogen are nitrate of soda and sulphate of ammonia. If you care to send us a sample of your soot we shall be pleased to determine the percentage of nitrogen for you.—R. D. WATT, Acting Chief Chemist.

TREATMENT OF CREAM, CHURNING, AND BUTTERMAKING.

I would be obliged if you would answer me the following questions. Does it deteriorate butter in any way to adopt the following methods:—

(1) By adding one gallon water to five gallons cream either at a temperature of 50° Fahr. or 90° to 100° Fahr. I ask this as I often want to raise the temperature of cream from about 50° to 60° Fahr., and by adding water only 75° requires too much.

(2) By adding water near boiling point would it spoil the grain?

(3) Does it affect the flavour of butter by too much washing where the milk won't separate easily from grain? I fancy the milk comes away more easily when water is added to the cream.

(4) Does leaving butter in a dish with some water in it to keep rag damp spoil the butter?

(5) Is it sufficient to stir cream morning and evening?—L. O. BEAN, Christiana.

Answer.—It certainly seems inadvisable to me to add water to cream in order to raise or lower the temperature; in fact I do expect it will affect the quality of the butter. A far better plan seems the following:—

Take a tank or tub with water, *hot* if you want to raise the temperature of the cream, cold if you want to lower it. Put the cream container or vat in this tank or tub and keep stirring the cream till it has reached the desired temperature.

(2) Water near the boiling point would certainly have a bad effect on the cream.

(3) Washing *always* affects the flavour of butter and the longer you wash the less flavour is left. It is a mistake to suppose that washing is indispensable. If you can cool your cream (directly after separating) down to 40° Fahr. and keep it at this temperature for some time (e.g. do not at once raise the temperature again artificially) you will find that the buttermilk will separate easily from the grain *without any* breaking water or washing water being used. Comparative experiments with washed and unwashed butter have shown that *unwashed* butter does *not* contain any more buttermilk than washed butter, provided it was worked properly and the cream had been cooled.

In some cases butter seems to spoil if you put it in a dish containing water and cover it up with a damp muslin cloth, yet I think such butter would spoil in any case; the damp muslin cools the butter. Cream should be stirred as frequently as possible, and I would not consider once in the morning and once in the evening as sufficient.—ROBERT PAPE, Superintendent of Dairying.

RELATIVE VALUES OF BUTTER, CREAM, AND MILK.

Will you kindly inform me what the relative values are of milk, cream, and butterfat, approximately, viz.:—

(1) What quantity of butterfat does one gallon of milk contain (of average richness)?

(2) What quantity of cream (separated) should one gallon of milk give (in weight and in measurement)?

(3) What quantity of butterfat should one gallon cream contain?

(4) What is the weight of one gallon milk?

(5) What is the weight of one gallon cream?

What I want to get at is: What is milk worth per gallon when butterfat is worth, say, 1s. per lb. I take it your reply can only approximately be given, as milk varies in richness.—F. E. TARLTON, Weltevreden, P.O. Britten.

Answer.—My replies to your questions must necessarily be somewhat vague. The average weight of one gallon of milk is near 10 lbs., sometimes more, sometimes less; 100 lbs. of milk contain about 3½ lbs. to 3 3-5th lbs. of butterfat. Milk may be separated so that 100 lbs. of milk (10 gallons) yield 8 lbs. of cream, or 12 lbs. and even 20 lbs. of cream. The weight of the cream varies with the fat percentage. This fat percentage varies with the fat in the original milk and the percentage of cream taken by the separator. If 100 lbs. of milk yield 8 lbs. of cream it is clear this cream will be half as rich again in fat as in the case where you get 12 lbs. of cream from 100 lbs. of milk.

You want to get at the value of milk when butterfat is worth 1s. per lb. Suppose you have 100 lbs. of milk (say, 10 gallons) of 3.50 per cent. butterfat at 1s., equals 3s. 6d., consequently one gallon is 3s. 6d. divided by 10 = 4.2d.—at 1s. 3d. per lb. butterfat, one gallon of milk would be at 5.3d. Say the milk contains 3.60 per cent. of fat then the value per gallon, at 1s. for butterfat, would be 4.7d., and at 1s. 3d. for butterfat it would be 5.4d.

Now let us vary the weight and assume one gallon to weigh 10.25 lbs., then at 1s. for the butterfat and with 3.50 per cent. fat the value of a gallon of milk is about 4.1d., and with 3.60 per cent. it would be about 4.2d. In general, I think you may say that, when selling cream for 1s. to 1s. 3d. per lb. butterfat, the return per gallon of milk will vary within the limits of 3½d. to 6d.

Now the richness of cream in fat starting with milk of 3.50 per cent., supposing you take 8 per cent. of cream, then the cream should contain a little over 40 per cent. of fat; "20 per cent. cream" should work out at about 17 per cent. fat in the cream.

Usually separators take 10 per cent. to 12 per cent. cream; in this special case (3.50 per cent. fat in milk), yielding cream containing about 33 per cent. to 28 per cent. of fat. If the milk is richer the figures vary. Say the milk contains 4 per cent. fat, then "10 per cent. cream" will contain about 39 per cent. of fat and "12 per cent. cream" again about 32 per cent.

The weight of a gallon of milk varies from 9½ lbs. to about 10¼ lbs. The weight of a gallon of cream varies considerably with the richness, and I should have to make special calculations for this purpose. I do not think figures for this would prove of much value.—ROBERT PAPE, Superintendent of Dairying.

NOXIOUS WEEDS: *STRIGA LUTEA*.

The enclosed weeds may interest you, and I shall be very glad if you will give me what information you can *re* same, and if you find anything worth while informing others through your journal will you please do so. This weed is very short, not growing more than 6 inches to 9 inches high, and has the most lovely tiny scarlet flower. I have it in one of my mealie lands and the natives told me it would kill the mealies; a white man born here told me when he saw it that the land was always finished for growing mealies when the weed appears, and that the mealies will grow up to 2 feet and then die off when this weed is in the land. I had a lot of "Iowa Silver Mine" mealies from the Government Experiment Farm, Potchefstroom, and put them in an old land which has not been manured for ten years, and I have had three crops of mealies from it; last year it gave seventy-one bags of clean cobs from six acres. This last November I planted the same sort of mealies in rows 8 inches deep (too deep), and fertilized with machine in furrow behind plough with Fison's mealie fertilizer 100 lbs. to the acre, rows 30 inches apart. They came up 3 inches to 4 inches and were wiped out by hail, then came along grandly with the dark green colour they ought to have after being fertilized, and stood splendidly, and now when I harvest I find no end of *bare* places. I don't think I'll get more than sixty grain bags of cobs (and these are poor ones) against the seventy-one last year with no manure (owing to the weed).

Another piece of mealies, ¾ acre (no manure), I planted very thick; they all came up but produced hardly any cobs, and in this place there is quite a lot of this weed. Both these are lands that have been used for many years.—GEO. W. LUNT, "Busby," P.O. The Brook, 15th May, 1909.

Answer.—The plant sent is known variously as rooi-blommetje, fire-weed, mielie-gift (mealie poison), and, botanically, as *Striga lutea*. It is a parasite on the roots of the mealie plant, and certainly has the effect of reducing the yield per acre. This weed also grows on the roots of Kaffir corn, zoet riet (*Sorghum saccharatum*), and other related grasses. It draws its nourishment mainly from the plant on which it grows as a parasite and thus robs the host of the food-material required for the proper development of grain.

Rooi-blommetje does not grow on leguminose plants, and this fact can be made use of for its eradication. By giving the land a good cleaning so that volunteer mealies and Kaffir corn are not allowed to grow on it, and by growing a crop of velvet beans, Kaffir beans, soy beans, or pea nuts, the development and spread of the weed will be checked because it appears to be quite unable to grow except in the presence of its proper host-plants. Moreover, by the growing of such crops the soil is enriched by the addition of nitrogenous material collected by the bacteria which live in the swellings ("nodules") on the roots.

By adopting a system of rotation of crops so that, say, one year out of three each part of your lands grows a leguminose crop, I think you will find that the soil is greatly improved and will probably be free from the rooi-blommetje, and the succeeding crops will be much benefited.—JOSEPH BURTT-DAVY, Government Agrostologist and Botanist.

WHITE MAIZE: ENQUIRIES FOR IN CANADA.

The following letters were received through the courtesy of the General Manager, Central South African Railways:—

To the Under Secretary for Agriculture.

I have to enclose herewith three copies of a communication the Canadian Trade Commissioner has handed to me, from the Archer Manufacturing Company of Canada asking to be put in touch with exporters of white mealies in this Colony.

The Trade Commissioner (Mr. J. A. Chesney) tells me that very large quantities of this class of mealies are imported into Canada every year by rail from distances up to 1,500 miles, and he is of opinion that the owners of Canadian steamers which visit these ports every month would be prepared to quote very low freights for a return cargo. Mr. Chesney also tells me that a trial shipment of these mealies made some time back were pronounced the best ever seen.

Early information of the names and addresses of probable suppliers is asked for to enable Mr. Chesney to reply to his correspondent.—A. H. WILSHERE, Controller of Customs, Capetown.

To Mr. J. A. Chesney, Capetown.

I am very much interested in the matter of Canadian manufacturers importing white corn from your vicinity. This commodity has always been imported from the United States, and we in this section are very heavy users of it as you are very probably aware.

My agency business takes me over territory such as the Eastern Provinces, Montreal, and Toronto vicinity as well, and I am very desirous of getting in touch with the exporters of this article. I could very well look after the territory I mentioned, and if the price will compete with the American product, a very large business can be done. Would you be good enough to place this letter in their hands that it may have prompt attention.—C. A. MORGAN, Manager, Archer Manufacturing Company, St. John, N.B.

CULTIVATION OF PEPPERMINT (*MENTHA PIPERITA*).

I would be much obliged for any information you can give me as to the chances of success with the "peppermint" crop in the Transvaal and the method of cultivating and extracting the oil.

I have information that with very little attention the crop returns a profit of about £22 per acre in the United States, America. —D. CLORAN, Cullinan.

Answer.—The peppermint might thrive in some parts of the Transvaal but I do not think it would prove a profitable crop to grow. The demand for peppermint is by no means unlimited, and, during recent years, the large supplies which have been available have caused the price in the United States of America to drop from \$2-\$5 (8s. to 20s.) per lb. to as little as \$1 (4s.) per lb. The average crop is estimated at 18 lbs. to 25 lbs. of essence per acre, so I think there must have been some mistake in the information you have received regarding the crop yielding a profit of £22 per acre.

Peppermint can be grown on land which will raise good crops of maize, but it thrives best on reclaimed vlei soils which are naturally fertile. The plant is a gross feeder, and on most soils frequent applications of manure are required.

Thorough cultivation of the land is essential, and at all times weeds must be vigorously kept under often by means of hand labour. When in bloom the crop is cut and converted into hay. After curing the plants are placed in a vat and steamed. The oil being volatile is carried over with the steam and the usual process of distillation follows.

From the above remarks you will see that the growing of peppermint is not likely to prove very remunerative, and I do not consider that, under present conditions, this crop is worthy of attention in the Transvaal.—H. GODFREY MUNDY, Assistant for Field Experiments.

DODDER IN LUCERNE.

In your last issue of the *Agricultural Journal* Mr. Guest wrote asking how to get rid of dodder in lucerne. In the Eastern Province of Cape Colony where I was farming for five years we got dodder in two of our lucerne lands, and we found that cutting and burning the infected lucerne was not a sure guarantee of getting rid of the pest, as in some cases when the lucerne grew again the dodder reappeared though it had been cut and burnt very carefully.

I found the best and surest way was to spray the infected patch with 1 lb. sulphate of iron to 1 gallon of water, then cut the infected lucerne as close to the ground as possible and all round for a couple of yards, gather up and bring to the centre of the patch and burn, being careful that no seeds fly about.

I hope this remedy will meet Mr. Guest's case and others.—C. V. MERRIMAN, Waterval.

EFFECT OF SUPERPHOSPHATE AND BONE MEAL ON MAIZE.

I ploughed up two new pieces of land last year near each other, and gave them the same treatment throughout last winter. This spring I planted one with Iowa Silver Mine 1st quality mealies, using superphosphate, and the other with Iowa Silver Mine 2nd quality mealies, using bone dust, both bags of seed coming from the Government Experiment Farm, Potchefstroom. Both lands have had the same treatment all along, the bone dust having been planted eight days later than the superphosphate.

The superphosphate mealies stand about 8 feet high, and I have counted stalks carrying five and six ears on them. The bone dust mealies, on the other hand, are standing about 4 feet 6 inches, and only just coming into seed, from which I estimate that they appear to be about three weeks later than the superphosphate. I am acquainted with the chemical analysis of both manures, but am at a loss to see why the superphosphate should so outpace the bone dust in growth, earlier ripening, and, as far as my experience takes me, a much heavier yield. At the same time I must tell you that, without the manures, I would say that the superphosphate land would give the heavier yield.

Again, the superphosphate land contains a light brown loam, a red loam, and a little heavy black vlei loam. The mealies are best on the first-named soil, and worst on the black as regards height and number of ears per stalk; but I find the thickest stalks on the black, and there the mealies seem to be about one week later. My bone dust land is all the light brown loam.—A. Langerman, Familie Hoek, P.O. Begin-der-Lijn.

Answer.—Allow me to compliment you on the enterprise you have shown in applying fertilizers to maize at all in a country where they are so dear. The results you have obtained are not very surprising to me except in the degree of the differences you mention. This Division has repeatedly pointed out how deficient our soils are in phosphate, and the good results likely to be got from the use of phosphatic fertilizers. We have, however, been rather reticent about advising people to use these fertilizers for maize until we could show by exact experiments that such manuring would pay. I hope you kept part of your land unmanured so as to be able to calculate the profit or loss per acre through manuring?

Now as to the explanation of the phenomena you mention. Though superphosphate and bone dust are both primarily phosphatic manures, there is a great difference between the action of the two. Superphosphate is much more soluble and quick-acting than bone dust, and gives a greater return in the first year, though in this country there must be a very considerable residue for the next year's crop. Bone dust, on the other hand, acts only slowly, and gives perhaps its greatest result in the second year. The small amount of nitrogen present in the bone dust would also tend to retard maturity, and the backwardness of the maize would be accentuated by the later application of this manure.

Again, the fact that the maize on the black land is later is due to the fact that black soils are always colder during the night than soils of any other colour, and are, besides, generally richer in nitrogen, which again has a tendency to retard the ripening process.

The effect of superphosphate in hastening the growth of crops, in stimulating the production of grain, and in causing an early harvest of grain of good quality, is known all the world over, and it is very interesting to find such striking confirmation in this Colony. I hope you will find it convenient to measure your maize land and calculate the yield per acre with the different treatments.—R. D. Watt, Acting Chief Chemist.

PS.—The actual weights obtained with the different methods of treatment will be found in the next issue of the Journal.—R. D. W.

BAGS FOR EXPORT OF MAIZE.

In connection with the export of grain from the Transvaal, my attention has been drawn to a rumour which is prevalent in the Middelburg and Bethal Districts to the effect that the Government has relaxed the regulations to the extent of allowing bags of 2½ lbs. weight to be utilized for maize intended for shipment oversea.

In order to controvert these rumours, I shall be glad if you will in your next isuse draw special attention to the fact that only 2¾ lb. bags will be allowed for this class of traffic overseas.—T. R. Price, General Manager, C.S.A.R., Johannesburg.

NEED FOR THE FORMATION OF A JUDGES' ASSOCIATION IN THE TRANSVAAL.

In the October, 1908, number of this Journal there appeared an article on "The Management of Agricultural Shows," by Mr. Matt. Lochhead, then secretary of the Transvaal Poultry Club, and now also secretary of the Pretoria Society of Agriculture and Industries. The author of that article dealt with receiving entries, late entries, Press reports, prize cards, etc., and I have no doubt that his suggestions were very useful and welcome to many of the secretaries of our agricultural societies, especially to those who were new to their duties.

I would have liked to see Mr. Lochhead go a little further and give some advice on the treatment of judges at shows. Those of us who have acted in that capacity have had some curious experiences, some pleasant, others the reverse; some amusing, others annoying, and so forth. Yet the man who is asked to judge is always expected to be only too pleased to put himself to a good deal of discomfort and often to expense, just for the sake of the honour and the glory of the thing. At some places judges are well treated, at others quite the reverse is the case: I ask therefore: "Is it not time that an association were formed for the protection of the interests of judges?" I have no doubt that judges can be had for the asking, but whether they have the confidence of the exhibitors is another question.

Further, the *system* of judging should be settled once and for all, and a decision should be reached whether to introduce single judging or whether to have two, three, or four judges for a section. The single judging system is to my mind the most satisfactory, as it is usually entrusted to a competent man who has confidence in himself, who knows that he is capable of judging, and who is willing to be responsible for his awards. Take, for instance, a case which recently came to my notice: There were four judges, two were in favour of giving a prize to one exhibit, and two maintained that it should go to another. How did these Solomons decide the question? They did not call in the umpire, but they came to the conclusion that if they were to put the numbers of the exhibits in a hat and draw lots the case would be met that way. The first number drawn got the prize, with the result that in order to satisfy the losing exhibitor an equal prize had to be given to him. If we had a Judges' Association, to which only competent judges were admitted, and if the Agricultural Union passed a rule that only such judges should be allowed to officiate as belonged to the Association, no such *faux pas* as this would be made.

Such an association, whilst guarding on the one hand against inefficient judges being allowed to officiate, would, on the other hand, protect the interests of the judges and lay down certain rules under which they should accept judging appointments. One of the questions to be dealt with should be the judges' expenses. I am not speaking of a fee, that is a matter which requires most careful consideration on the part of the societies as well as on that of the judges. But I submit that a judge should be as little out of pocket as possible. I have known cases where judges were kept out of their actual out-of-pocket expenses for railway fare and hotel expenses for over six months, and then they could only get the amount after threatening with legal proceedings. I do not suppose that the amount involved—say £3 or £4—would either "make" or "break" the man who expended it. It becomes, however, a serious

matter if a judge officiates at say a dozen or more shows during a season and he has constantly to put his hand in his pocket.

Is it asking too much to expect to be provided with a railway warrant from the society concerned, and to have actual hotel expenses paid by it? It was done this year by the Johannesburg Agricultural Society, and I am sure it saved the secretary a good deal of correspondence and trouble afterwards. In most cases the secretary sends the judge a certificate, under which the latter is entitled to travel at a reduced rate. The judge pays, and after the show is over he enters into correspondence with the secretary for the recovery of this outlay, and probable after expenses. The secretary sends his cheque with a letter of thanks, and the matter is apparently closed. But this is by no means always the case. Last season I had reclamation from the railway authorities calling for additional payment in no less than three cases. Mistakes had been made by the booking clerks, and the fare undercharged, 3s., 4s., or 5s., as the case may be, and the judge (who does not like the idea of the booking-clerk having to pay) remits the difference to the railway authorities and looks pleasant. He does not want to reopen the case with the secretary, and so loses the difference. If the society provides the warrant instead of the certificate the railway will recover from the society and not from the judge.

Again, take the provision of accommodation when the judge arrives at the place where the show is held. At some places everything possible is done to make him comfortable and his stay agreeable. He has been informed by the secretary of the show where quarters have been provided for him, and all he has to do is to go there and he will be looked after. At other centres nothing whatever is done. One is often put to great inconvenience and discomfort, and I repeat that the least a judge can expect is proper provision for his accommodation. We give the benefit of our experience to the societies who do us the honour of asking for it, free, gratis, and for "noddings," and in return only ask for a little consideration. A Judges' Association would soon put matters on a proper footing.

Again, there is the objectionable practice of asking the judge of one section to judge another of which he probably knows nothing. In travelling to a show the other day in the company of my friend "Lambwool," who is known as an expert in judging sheep, he told me that on three or four occasions he had been asked to judge pigs as well, and that he knew absolutely nothing about pigs. It so happened that the next day on the show ground the secretary told me that there was no judge for pigs, and did I know of any one who could judge them? No better man than Mr. "Lambwool," I replied, and the secretary at once hied himself to where my friend was judging sheep, and asked him would he kindly judge pigs after he had done with the sheep. There were "razors in the air" for a few minutes until the secretary explained why he asked Mr. "Lambwool." I was careful to keep out of my friend's way during that show.

Natal has a Judges' Association, and so has the Orange River Colony, and I believe the Cape Colony also. The Transvaal, which is otherwise leading in up-to-date agricultural methods and associations and societies, should certainly not be behind our sister Colonies. There is a Judges' Conference to be held at Bloemfontein in July, to which delegates from the Transvaal Agricultural Union have been invited, and it is to be hoped that these delegates will come back full of useful information which will lead to the immediate formation of a "Transvaal Judges' Association."—J. Huneberg, Pretoria.

DESTRUCTION OF RATS.

In your January, 1909, issue of the Journal, page 313, Mr. Cornelius van der Westhuizen wants to know how to get rid of rats about the house and buildings.

If he can get two or three long oil drums or big buckets and fill them within about two inches of the top with grass or straw, let him put some food they like, such as oats, wheat, crushed mealies, pumpkin seed, or sunflower seed, and keep putting it on fresh every evening for about a week or so until they get used to it. Then remove the grass and fill it to within three inches of the top with water and put oat or wheat chaff on the top; the rats will jump in and drown quickly. By having five or six tins about his buildings he will soon be rid of rats, but he must keep on feeding them for a time with fresh food so as to get them accustomed to the drums.—W. R. LYE, Zonderfout, near Delmas Station.

Editorial Notes.

Bags for Export of Maize.—We have been informed by the General Manager, Central South African Railways, of a rumour prevalent in the Middelburg and Bethal Districts to the effect that the Government has relaxed the regulations to the extent of allowing bags of 2¼ lbs. weight to be utilised for maize intended for shipment oversea. We have, therefore, been requested by Sir Thomas Price to call our readers' special attention to the fact that only 2½ lb. bags will be allowed for this class of traffic oversea.

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Standard Weight of Bags of Maize for Export.—We are also advised by the General Manager that in the near future the Railway Administration will insist on maize bags being filled to weigh 203 lbs. In this connection we would call the attention of our readers to the illustration (Plate 113) of a convenient form of scale for weighing sacks of produce, which can now be obtained from hardware merchants at the cost of about 25s. These scales are provided with a pair of chains and hooks for holding the bag open while being filled to the exact weight. We understand from persons who have used this scale that it weighs accurately.

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Maize Quotations on the English Market.—Attention is called to the table given under "Useful Facts and Figures for Farmers," for the ready conversion of English market quotations for maize into the Transvaal equivalent. Maize is sold by weight in the English market, the unit being the "quarter" of 480 lbs. Many farmers find it difficult to make a quick and accurate comparison between the English prices as printed in the market lists at the railway stations, and sometimes in the daily papers, and the daily prices on the Johannesburg market. For practical purposes, it is only necessary to remember that 24s. per quarter is equal to 10s. per muid, 36s. per quarter is equal to 15s. per muid, and for every 6s. per quarter a difference of 2s. 6d. per muid, and for every 1s. per quarter, above or below, a difference of 5d. per muid should be made.

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Maize Food in Europe.—The possibilities of increasing the demand in Europe for South African maize have been well realised by the South African National Union, which, at the recent congress in Kimberley, brought forward the following resolution, proposed by Mr. G. A. Roth, Pretoria, and seconded by Mr. W. J. Palmer, Director of Agriculture, Orange River Colony:—"That in view of the anticipated shortfall in the world's wheat crop an excellent opportunity presents itself for increasing the demand for maize and other cereal foods, for which it is reported additional inquiries have already been made." Resolved that it be an instruction to the General Executive to arrange the distribution throughout England and the Continent of, say, one million pamphlets containing recipes for preparing maize foods, also to arrange demonstrations at the schools of cookery at South Kensington and other places. The pamphlet referred to consists of a revised edition of the Transvaal Department of Agriculture Farmers' Bulletin No. 1, now on distribution at this and other exhibitions. Further, that the General Executive should approach the Governments of the Transvaal and Natal to defray the cost of printing and distribution of these pamphlets.

It seems very necessary that something of this kind should be done, and apparently this is the opportune time at which to do it, as several English papers have intimated their intention of writing up the subject as soon as they have sufficient information. To make the proposed demonstrations at cookery schools successful, they should be conducted by some one who has experience in preparing maize foods, because a good cook appears to require more knowledge than that of the actual ingredients that go to make up the dish. There is some indefinable knowledge that comes only as the result of actual experience, and unless the cook knows from personal experience how the preparation should taste she may turn out something quite unpalatable.

New Municipal Abattoir and Live Stock Market, Johannesburg.—During the month of April the foundation stone of the new Municipal Horse and Cattle Sale Yards, Johannesburg, was unveiled, and that of the new Municipal Abattoir was laid. These are important steps forward in the development of the country, from the point of view both of public health and of the development of a large and important cattle trade. The Municipal Council has sanctioned an expenditure of £76,800 for the erection of the abattoir buildings and the laying out and equipment of the horse and cattle markets, and it is hoped that in the near future the arrangements that are being made will enable farmers and stock-dealers to create a cattle trade in Johannesburg second to none in South Africa. The establishment of a properly-equipped and fenced-in abattoir, with the necessary kraals, will, of course, be of inestimable advantage to outside farmers and stock-dealers, and at the same time it will, it is hoped, help to cheapen the price of meat to consumers.

Ten acres of ground in Newtown, adjoining the Kazerne, have been allotted by the Council, four for the abattoir and six for the live stock market, and provision has been made for future extension of the buildings, etc., as may be found necessary. The Central South African Railway Administration is contemplating the construction of cattle sidings on the northern boundary of the live stock market and a loop line into the abattoir.

The buildings are being constructed on the most modern principles. The floors of all slaughter stalls will be constructed of concrete and the walls lined with glazed tiles.

Covered lairages, fitted with water-troughs and hay-racks, are being provided for the accommodation of 400 oxen, 3,000 sheep, and 400 pigs awaiting slaughter.

The live stock market comprises two blocks of ground; one measuring 330 feet by 287 feet, with a roadway 25 feet wide passing through the centre, is set aside for cattle, sheep, and pigs. It will be paved throughout with vitrified grooved stable bricks; cattle pens, constructed of tram rails, to accommodate 90 cows and 700 oxen; sheep pens constructed of bar iron for 4,000 sheep; and pigstyes, constructed of hard blue bricks, to hold 400 pigs, will be erected thereon. All the pens will be provided with water-troughs, and a portion of them with feeding racks. Four sale rings will be placed at the side of the roadway running through this area, and three of these will have weighing machines with self-registering dials. The other block is reserved for horses, mules, and donkeys.

There is also a movement on foot to move the produce market to an adjoining site.

WITWATERSRAND AGRICULTURAL SHOW.—The show of the Witwatersrand Agricultural Society was this year held on 14th, 15th, 16th, and 17th April, and proved a great success, both entries and attendance being better than in previous years. We heartily congratulate the society on the excellent management of the show and on the high standard attained, which place it second to none in South Africa. Visitors were particularly struck with the improvements effected in the show grounds during the year, including the new buildings, particularly the picturesque and well-equipped dairy and the large lecture-hall.

Four days seem a long time for the duration of a single show, but when there is as much to see and learn as at the Johannesburg show, the time can be spent to good advantage. A visit to a show such as this is of great educational value, both to the farmer and to the general public. The farmer is able to see some of the best stock, produce, and machinery, not only of the Transvaal, but also from other parts of South Africa, and by comparison is able to see where he can improve. Meeting other farmers he compares notes with them and picks up new ideas which help him in his work. Seeing good implements and good exhibits of seed, he learns where he can obtain them. We were glad to see a larger number of practical farmers present than formerly, and hope the farming population of this country will come to realise more fully that a visit to a show such as that at Johannesburg is a valuable means of instruction, and is well worth the time and money spent.

A new feature of the show this year was the lectures on dairying, cattle-judging, fruit-growing, poultry-raising, maize-growing, and stock diseases, by members of the Department of Agriculture. Unfortunately, these were poorly attended.

The maize exhibits showed a marked improvement in quality over last year. The special prize offered by the Government Botanist for the best 25 ears of any breed brought out eleven entries, and the competition was close. The prize will be repeated next year, and it is hoped the entries will be much more numerous. The largest number of maize prizes was carried off by Messrs. John Fowler & Co. (Leeds), Limited, with samples grown on their maize farms at Vereeniging.

An outstanding feature of this year's show was the large number of horses exhibited. Of thoroughbred yearlings there were about sixty, which is probably the largest number seen at any one show in South Africa; these were afterwards offered by auction, for racing purposes, Johannesburg being the principal centre of racing in South Africa.

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LIVE STOCK AT THE JOHANNESBURG SHOW.—Mr. Holm, general manager of the Government Experiment Farm, Potchefstroom, has kindly furnished the following notes on the live stock:—In the sections provided for cattle, sheep, goats, and pigs, there was a substantial improvement when compared with previous years, especially among cattle and pigs. Indeed, it is pretty safe to aver that the exhibition of these was quite equal to, if not superior to, that held at any show in South Africa this year. The presence of stock from the Government stud and experiment farms raised the standard of the exhibits to a very great extent, but apart from these there were many animals of outstanding merit, a most satisfactory feature, considering that the Colony was practically depleted of pure-bred stock less than seven years ago.

In the cattle section, Friesland and Lincoln red shorthorns were best represented, and among each of these were many animals of a high

standard. Among Frieslands there were no bulls of exceptional merit, with the exception of the Government animal, "Theunis" (see Plate 115) which was generally admitted to be probably the best bull of the breed in South Africa; but there were a number of useful young bulls and several really good cows and heifers. Mr. Moore's cow, a big, good quality animal, essentially of the milking type, secured the championship for the best female of the breed.

In Lincoln reds, Sir Geo. Farrar, Mr. L. Bagshawe-Smith, and the Hon. H. Scott sent forward many good animals; indeed from the point of view of individual merit of the exhibits, this breed occupied premier position.

The champion bull of the breed was found in Sir George Farrar's "Bracebridge Sudbrook No. 10," and the highest award for the best female was won by the Government exhibit, "Stenigot Gwynne XIII." Among private exhibitors, Sir George Farrar's group of Lincoln reds also won the 100 guineas challenge cup, the Government exhibit of Ayrshires from Potchefstroom, a quintette of exceptional merit, and not easily beaten, being placed first in open competition.

Following the two aforesaid breeds, Ayrshires took the next position, both in point of numbers and general excellence. In addition to the Government exhibits, there were good animals from Cape Colony from the noted herd of Mr. J. Rawbone, together with several animals sold by the last-named breeder at the previous show. These hardy dairy cattle are apparently increasing in popularity.

The Hereford breed was practically confined to the Government exhibits from Potchefstroom and Standerton, and it was well represented by many excellent specimens of these hardy beef cattle (see Plate 116).

Mr. T. Cullinan, M.L.A., showed several useful Red-polls, and Mr. F. T. Nicholson was again highly successful with exhibits from his herd of Jerseys. Devons made a rather disappointing display.

Specimens of the Sussex and Aberdeen-Angus breeds were shown from the Government farms. The classes for dairy cows brought forward many excellent animals, chiefly cross-bred Frieslands and Ayrshires.

On the whole, there was a smaller number than usual of animals which should never enter a showyard, but in some cases cross-bred or grade cattle were entered in pure-bred classes. Exhibitors should not do this, as it only leads to disqualification of the exhibits.

The sale of stock on the showyard was more successful than hitherto. Many animals were disposed of at fairly satisfactory prices to the breeders. Friesland bulls were sold up to 52 guineas, and Ayrshire bulls up to 30 guineas, while several heifers of these two breeds fetched prices ranging around 20 guineas.

The Johannesburg Show has hitherto failed to attract a large exhibit of sheep; doubtless the lateness of the date accounts for this. Nevertheless, many first-class merinos were brought forward, the flocks of Mr. A. Bailey, M.L.A., the African Farms, Ltd., and Messrs. A. & V. Robertson being the most successful. The sheep sent from the Government Stud Sheep Farm at Ermelo, and which were now entered in competition for the first time, gained the highest awards in most of the classes in which they competed. There was a good entry of slaughter sheep, Suffolk and Shropshire crosses from the Government farm at Potchefstroom securing highest honours, followed by heavy Shropshire-merino crosses exhibited by the Messrs. Nourse.

The show of pigs was probably the best and most representative yet held in South Africa, and it was evident that many breeders are paying earnest attention to the breeding of first-class animals.

Yorkshires (chiefly large white), Berkshires (large blacks), and Tamworths were all exhibited. The two black breeds appeared to be the most favoured. Many excellent pigs of the Berkshire and large black breeds, which would have been a credit to any show in the country of their origin, were exhibited. The chief prize-winners in the pig section were Sir George Farrar, M.L.A., Messrs. Norma & Royce, Hobbs & Bennett, Chas. E. Hodgson, W. MacLelland, and F. Henderson, while the Government exhibits from the Potchefstroom farm had an unbeaten record.

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THE SCANDINAVIAN ORIGIN OF THE HORNLESS CATTLE OF THE BRITISH ISLES.—Professor James Wilson read a paper before the Royal Society of Dublin on the 23rd March, in which, according to *Nature*, he advanced the view that the British hornless breeds of cattle are neither reversions to an older hornless type, nor spontaneous variations, as Darwin believed, from the horned to the hornless condition. He concludes that they were introduced into the Norse Settlements of the British Isles before A.D. 1066, and not before the end of the Anglo-Saxon invasion, and were, in all probability, descended from the cattle of the Scythians, referred to by Herodotus, and tracing back either to Egypt or Western Asia. Besides being hornless, these cattle agreed in several other characteristics with cattle found in other Norse Settlements, e.g. Normandy, the Channel Islands, North Holland, Orkney, Shetland, and Iceland.

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RESIGNATION OF MR. H. GODFREY MUNDY.—Since the last issue of the Journal our colleague, Mr. H. Godfrey Mundy, P.A.S.I., Assistant for Field Experiments in the division of Botany, has accepted the post of Agriculturist and Botanist to the Rhodesian Department of Agriculture. While greatly regretting the loss of Mr. Mundy's services and agreeable personality, we congratulate him on his promotion to such a responsible post. In wishing him every success we are sure that we are expressing the hearty wish of those farmers throughout the Transvaal with whom Mr. Mundy has come in contact in the course of his field work.

It is interesting to note how the Transvaal Department of Agriculture is supplying trained men to fill posts in other parts of the world. These include Mr. Stewart Stockman, now Principal Veterinary Surgeon to the British Board of Agriculture; the Hon. A. C. Macdonald, Director of Agriculture, British East Africa; Mr. J. A. Kinsella, Dairy Expert, now in New Zealand; Mr. C. W. Howard, Government Entomologist, Portuguese East Africa; Dr. McCrae, Government Analyst, Johannesburg; Mr. H. C. Sampson, Deputy Director of Agriculture, Madras Presidency, India; Mr. Heron, Government Veterinary Bacteriologist, Portuguese East Africa; Mr. Conacher, Principal Veterinary Surgeon, Portuguese East Africa; and now Mr. H. Godfrey Mundy, Agriculturist and Botanist, Salisbury, Rhodesia.

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REPORT OF THE COUNTRY LIFE COMMISSION OF THE UNITED STATES.—A most interesting and instructive document has reached us through the courtesy of a former resident and contributor to this journal, Miss Florence Bolton, now of California. It is the report to the President of

the United States of a Special Commission appointed by him to investigate the conditions of country life in America.

In his message transmitting the report to Congress, Mr. Roosevelt states that "farming does not yield either the profit or the satisfaction that it ought to yield and may be made to yield. There is discontent in the country, and in places discouragement. Farmers as a class do not magnify their calling, and the movement to the towns, though, I am happy to say, less than formerly, is still strong." "There are three main directions in which the farmers can help themselves, namely, better farming, better business, and better living on the farm." He alludes to the splendid services rendered by the Federal Department of Agriculture "equalled by no other similar department in any other time or place"; the State Departments of Agriculture, the State Colleges of Agriculture and the Mechanic Arts, especially through their "extension work," and the State Agricultural Experiment Stations, which have all "combined to place within the reach of the American farmer an amount and quality of agricultural information which, if applied, would enable him, over large areas, to double the production of the farm." He expresses the belief that farming will ultimately become one of the most dignified, desirable, and sought-after ways of earning a living.

"Those engaged in all other industrial and commercial callings," he adds, "have found it necessary, under modern economic conditions, to organise themselves for mutual advantage and for the protection of their own particular interests in relation to other interests. The farmers of every progressive European country have realised this essential fact, and have found in the co-operative system exactly the form of business combination they need. . . . The introduction of effective agricultural co-operation throughout the United States is of the first importance. Where farmers are organised co-operatively, they not only avail themselves much more readily of business opportunities and improved methods, but it is found that the organisations which bring them together in the work of their lives are used also for social and intellectual advancement. . . . The co-operative plan is the best plan of organisation wherever men have the right spirit to carry it out."

President Roosevelt advocates that the United States Department of Agriculture, through which as prime agent the ideas which this commission stands for must reach the people, should become, without delay, a "Department of Country Life," fitted to deal not only with crops, but also with all the larger aspects of life in the open country." Three great general and immediate needs of country life stand out :—

"First, effective co-operation among farmers to put them on a level with the organised interests with which they do business.

"Second, a new kind of schools in the country, which shall teach the children as much outdoors as indoors, and perhaps more, so that they will prepare for country life, and not as at present, mainly for life in town.

"Third, better means of communication, including good roads, and a parcels post.

"To these may well be added better sanitation.

"Everything resolves itself in the end into the question of personality. Neither society nor Government can do much for country life unless there is voluntary response in the personal ideals of the men and women who live in the country. In the development of character the home should be more important than the school or than society at large.

"Upon the development of country life rests ultimately our ability, by methods of farming requiring the highest intelligence, to continue to feed and clothe the hungry nations. To supply the city with fresh blood, clean bodies, and clear brains that can endure the terrific strain of modern life, we need the development of men in the open country, who will be in the future, as in the past, the stay and strength of the nation in time of war, and its guiding and controlling spirit in time of peace." The following extracts from the report apply in many cases as much to South Africa as to the United States :—

"The underlying problem of country life is to develop and maintain on our farms a civilisation in full harmony with the best American ideals. To build up and retain this civilisation means, first of all, that the business of agriculture must be made to yield a reasonable return to those who follow it intelligently, and life on the farm must be made permanently satisfying to intelligent, progressive people.

"To improve any situation, the underlying facts must be understood. The farmer must have exact knowledge of his business and of the particular conditions under which he works. The United States Department of Agriculture and the experiment stations and colleges are rapidly acquiring and distributing this knowledge, but the farmer may not be able to apply it to the best advantage because of lack of knowledge of his own soils, climate, animal and plant diseases, markets, and other local facts. The farmer is entitled to know what are the advantages and disadvantages of his conditions and environment. A thorough-going system of surveys in detail of the exact conditions underlying farming in every locality is now an indispensable need to complete and apply the work of the great agricultural institutions. As an occupation, agriculture is a means of developing our internal resources ; *we cannot develop these resources until we know exactly what they are.*

"There must be not only a fuller scheme of public education, but a new kind of education adapted to the real needs of the farming people. The country schools are to be so redirected that they shall educate their pupils in terms of the daily life ; the schools do not train boys and girls satisfactorily for life on the farm, because they allow them to get an idea in their heads that city life is better, and to remedy this practical farming should be taught. Opportunities for training toward agricultural callings are to be multiplied and made broadly effective. Every person on the land, old or young, in school or out of school, educated or illiterate, must have a chance to receive the information necessary for a successful home and neighbourhood. This means redoubled efforts for better country schools and a vastly increased interest in the welfare of country boys and girls on the part of those who pay the school taxes. Education by means of agriculture is to be a part of our regular public school work. Special agricultural schools are to be organised. There is to be a well-developed plan of extension teaching conducted by the agricultural colleges, by means of the printed page, face-to-face talks, and demonstration or object lessons, designed to reach every farmer and his family, at or near their homes, with knowledge and stimulus in every department of country life.

"There must be a vast enlargement of voluntary organised effort among farmers themselves. It is indispensable that farmers shall work together for their common interests and for the national welfare. If they do not do this no governmental activity, no legislation, not even better

schools will greatly avail. The farmers are relatively unorganised. We have only begun to develop business co-operation in America.

"The greatest pressure on the farmer is felt in regions of undiversified one-crop farming. Under such conditions he is subject to great risk of crop failure; his land is soon reduced in productiveness; he usually does not raise his home supplies, and is therefore dependent on the store for his living, and his crop being a staple and produced in enormous quantities, is subject to world prices and to speculation, so that he has no personal market. In the exclusive cotton and wheat regions the hardships of the farmer and the monotony of rural life are usually very marked. Similar conditions are likely to obtain in large areas of stock ranging, hay raising, tobacco growing, and the like. In such regions great discontent is likely to prevail, and economic heresies to breed. The remedy is diversification in farming on one hand and organisation on the other."

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SLEEPING SICKNESS.—*Nature* reports that the Sleeping Sickness Commission, under Sir David Bruce, stationed in Uganda, has repeated Dr. Kleine's experiments with *Trypanosoma gambiense* and *Glossina palpalis,* also with a trypanosome of the dimorphon type and the same tsetse-flies, and found the flies infective after sixteen, nineteen, and twenty-two days.

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WESTERN PROVINCE AGRICULTURAL SOCIETY—"Alfred Beit" Challenge Cup for Merino Rams.—In connection with the 1909 Rosebank Show, a special challenge cup, value £50, for merino rams, was kindly offered for competition by the executors of the late Mr. Alfred Beit. The conditions were that rams entered for the prize had to be brought to the 1908 show and be there shorn bare. The rams had to be run under natural conditions for twelve months, to be again shorn bare at the 1909 show, the fleeces then to be hot-water scoured, weighed, and valued, the cup being awarded for the ram giving the greatest monetary value of scoured wool. Mr. R. Starke, of Oatlands, Durbanville, kindly placed his farm at the disposal of the society, so that the rams could be kept under precisely similar conditions. There were eight entries for the prize, but unfortunately one of the rams died during the period of the test. The remaining seven were brought to the 1909 show in excellent condition. On shearing the rams, the following results were obtained, the fleeces being submitted to three of the leading wool merchants of Capetown, so as to arrive at a fair estimate of the value:—

Exhibit No.	Owner.	Weight of Fleece in Grease.	Valued at per lb. in Grease.
276	J. H. King	24½ lbs.	6d.
277	F. C. Bayly	35 ,,	3¾d.
278	C. Adams & Son	21¾ ,,	4⅓d.
279	G. King & Sons	20 ,,	7⅓d.
280	A. H. Frost	30½ ,,	5d.
281	J. G. Sieberhagen	28¾ ,,	6½d.
282	J. G. Sieberhagen	24¾ ,,	4½d.

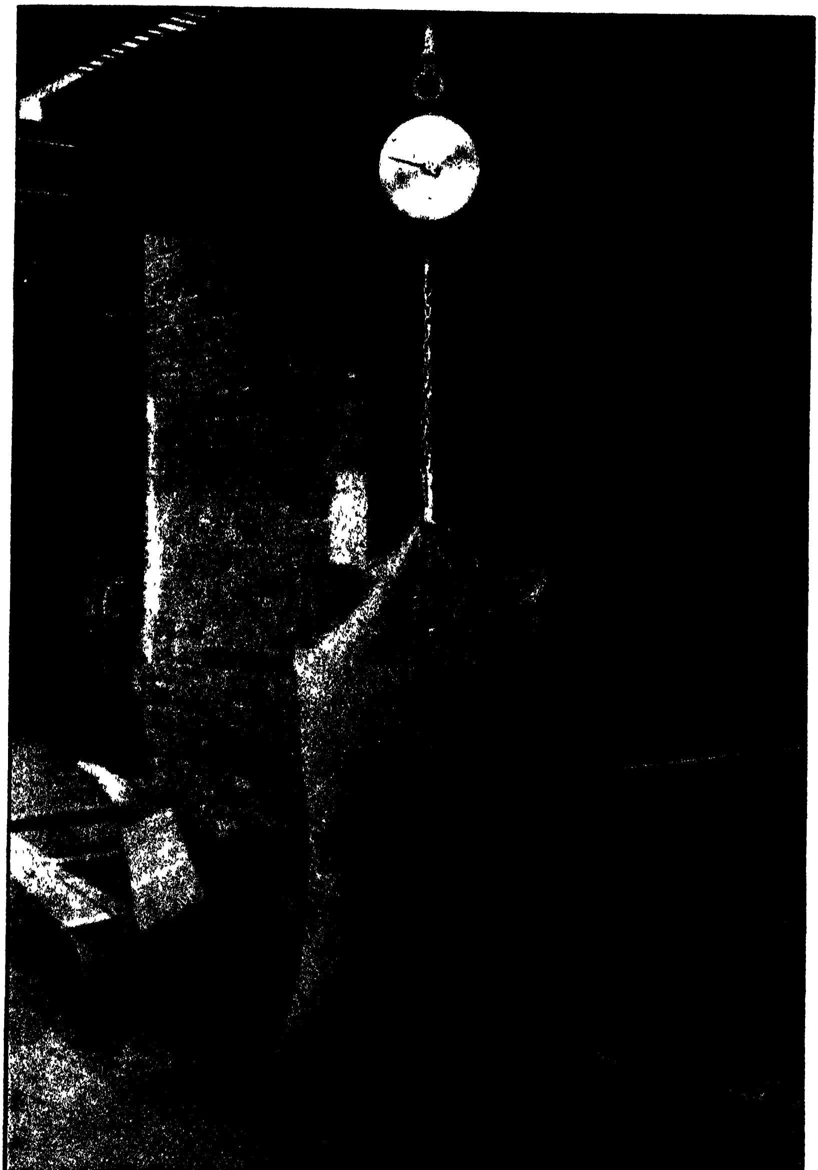

Plate 113. **Scale for Weighing Maize in the Sack.**

Price about 25s.

Plate 114.

Making a Pit Silo at Messrs. John Fowler & Co.'s Maize Farms, Vereeniging.

Messrs. Fowler have made about 600 tons of silage this year.

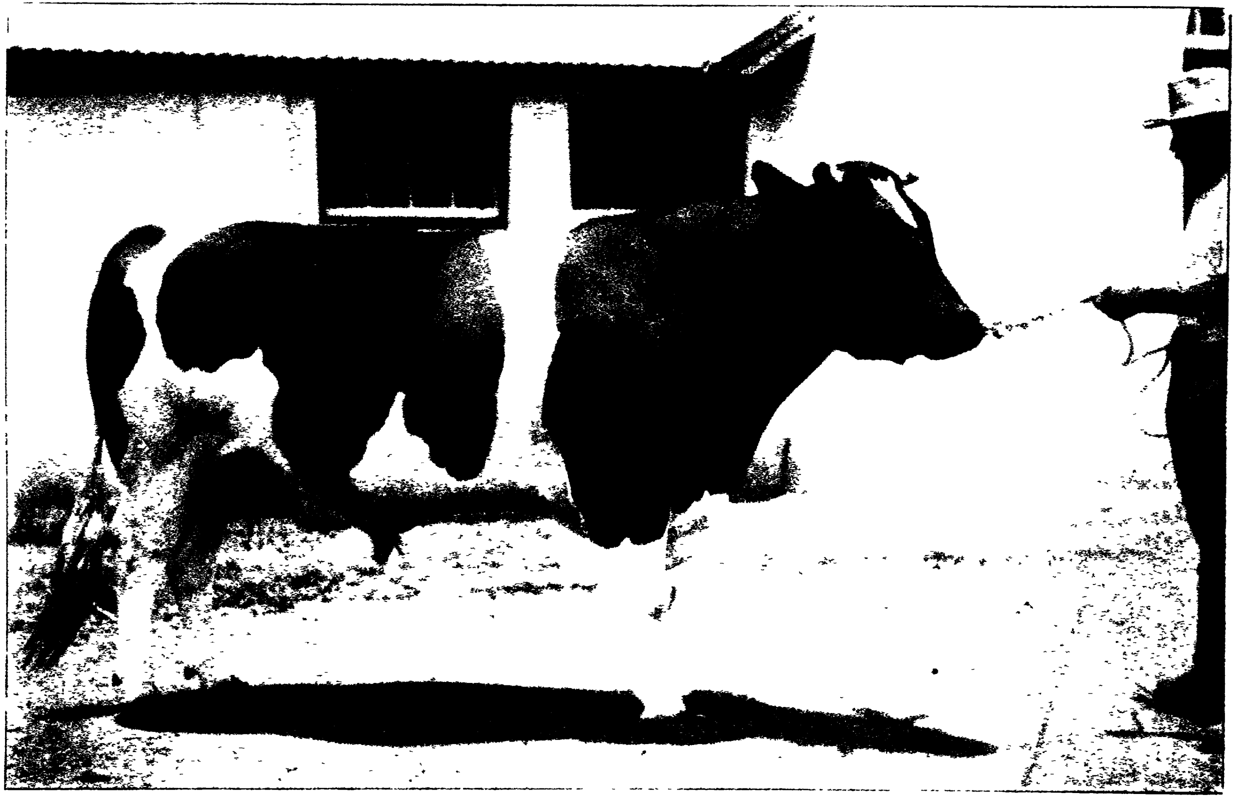

Plate 115. **"Theunis" (F.R.S. 3486); age 3 years.**

Champion Friesland Bull, Johannesburg Show 1909. Stud bull at Experimental Farm, Potchefstroom.

Plate 116. **"Noke Gallant" (25606); age 3 years.**

Champion Hereford Bull, Johannesburg Show, 1909. Stud bull at Experimental Farm, Potchefstroom.

The fleeces, after being hot-water scoured, gave the following results:

Exhibit No.	Owner	Weight of Scoured Wool.	Valued at per lb.	Total Value.
276	J. H. King	8 lbs. 10 ozs.	1s. 4¾d.	12s. 0½d.
277	F. C. Bayly	8 ,, 9 ,,	1s. 2½d.	10s. 4d.
278	C. Adams & Son ...	7 ,, 9 ,,	1s. 4d.	10s. 1d.
279	G. King & Sons ...	7 ,, 2 ,,	1s. 6d.	10s. 8d.
280	A. H. Frost... ...	8 ,, 15 ,,	1s. 4d.	11s. 11d.
281	J. G. Sieberhagen ...	10 ,, 6 ,,	1s. 5d.	14s. 8d.
282	J. G. Sieberhagen ...	7 ,, 6 ,,	1s. 5½d.	10s. 9d.

Thus Exhibit No. 281, the property of Mr. J. G. Sieberhagen, came out an easy winner. The quality of Exhibit No. 279 was more favoured by the judges, but this fleece, being much lighter, bore no comparison when monetary value was taken into account. It may be mentioned that all the fleeces were somewhat burry, owing to the nature of the veld on which the sheep had run, but this was not taken into consideration by the judges when estimating the value.

The loss in scouring will no doubt come as a surprise to many breeders, ranging as it did from about 65 per cent. to 75 per cent. The test proved a very interesting and instructive one, and it is hoped that funds will admit of its being repeated in future years.

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INFLUENCE OF FORESTS ON NATURAL WATER SUPPLY.—We have received from Mr. C. D. H. Braine, of the Irrigation Department, a copy of an interesting paper on this subject presented by him to the meeting of the South African Association for the Advancement of Science held at Grahamstown in 1908. Mr. Braine points out, among other things, the importance of tree-planting for checking the torrential run-off of our summer rains and the resulting floods, as well as for maintaining the permanence of streams. The paper should be read by all who are interested in tree-planting or in the conservation of water; the article will be found in the annual report for 1908 of the South African Association for the Advancement of Science, to be had from the African Book Company, Grahamstown.

* * * *

LAVERAN'S EXPERIMENTS WITH TRYPANOSOMES.—At a meeting of the Paris Academy of Sciences on the 29th March, Mons. A. Laveran presented an account of some experiments with Trypanosomes, which is summarised in *Nature*. Two sheep were inoculated with *Trypanosoma pecaudi* and became infected; at the end of six months they were cured, and were completely immune against this organism. Inoculated then with *T. dimorphon* they were infected like new animals. One of them, after cure, had not acquired immunity against *T. dimorphon*, but the other proved to be immune. The latter animal, then inoculated with *T. congolense*, contracted the infection. These observations confirm the original view that these three trypanosomes belong to entirely different species.

ARROWROOT CULTURE.—Some enquiry has recently been made by correspondents in the Eastern Zoutpansberg with regard to the possibilities of the arrowroot industry.

In parts of the West Indies the growing of arrowroot and sugar-cane became unprofitable a few years ago, and Sea Island cotton has gradually replaced them.

Arrowroot is also grown in Queensland. According to a writer in *Tropical Life*, it was first planted there forty-four years ago. The plant grows luxuriantly on all the coast lands, from the Tweed on the southern border to Cooktown in the far north. In the south the industry is carried on principally on the Pimpama and Coomem Rivers. Here there are steam-driven mills ranging in capacity from 10 cwts. to 30 cwts. of farina per day. The average yield may be set down at from one to two tons of farina per acre, which sells at prices fluctuating between £12 and £20 per ton.

* * * *

ADDITIONS TO THE DEPARTMENT OF AGRICULTURE STAFF.—Mr. C. H. Keet has been appointed Government maize grader on the staff of this Department, *vice* Mr. F. P. Jacobsz, who has been appointed general manager of the Government Sheep Stud Farm at Ermelo.

Mr. W. M. Scherffius, of the Kentucky State Agricultural Experiment Station, has been appointed chief of the Tobacco Division; Mr. V. C. Brewer has been appointed manager of the Tobacco Station at Barberton; Mr. H. W. Taylor, as manager of the Tobacco Station at Rustenburg; and Mr. O. B. Chisholm is at present engaged at the head office, but will later take charge of one of the stations. These gentlemen are thoroughly trained in tobacco work, and will do their best to develop this promising industry in the Transvaal. It is, of course, too soon to expect them to express an opinion as to the possibilities of an export trade in Transvaal tobacco.

* * * *

LUCERNE GROWING IN CALIFORNIA.—The Director of the California State Agricultural Experiment Station writes, *inter alia*, of lucerne cultivation in that State: —

"Alfalfa is certainly a world beater, and it is an interesting fact that the extension of the acreage in States where it has been long known, as in California, keeps pace with its extension in newer regions. Just at the present time, for instance, there is perhaps a wider interest in alfalfa growing in California than ever before."

* * * *

TOBACCO WASHES AS INSECTICIDES AND FUNGICIDES.—The efficacy of these washes is referred to in the Journal of the *Royal Horticultural Society*, vol. xxxiv, pt. iii, which reports the proceedings of a conference on the spraying of fruit trees held last October.

* * * *

NEED FOR THE FORMATION OF A JUDGES' ASSOCIATION IN THE TRANSVAAL.—Attention is called to the letter on page 762 from our friend Major Huneberg emphasising the desirability of establishing an Agricultural Judges' Association for the Transvaal, to guard on the one hand against the appointment of inefficient judges, and on the other to protect the interests of the judges themselves. The Orange River Colony and Natal have such Associations, and we believe Cape Colony also, and it seems as if the time were ripe for the Transvaal to come into line. We heartily endorse Major Huneberg's plea.

SUSSEX CATTLE.—The Journal of the Royal Agricultural Society for 1908, contains a paper by Mr. H. Rigden on Sussex cattle, which are described as larger, bigger boned, and more hardy in constitution than the Devon, to which they are nearly allied. He considers that both breeds are probably derived from old medium-horned cattle of the south and south-western counties. Sussex cattle should be wholly red in colour, with white tail-tufts, but white flecks may appear on the body, and the muzzles of the bulls must be white. The Sussex cattle have been noted for their long and strong limbs which specially fitted them for trekking purposes on rough forest roads.

* * * *

JOURNAL SETS FOR SALE.—Attention is directed to the advertisement of two complete sets of the *Journal* (Nos. 1 to 28) offered for sale, as we so frequently receive applications for back numbers, many of which are now out of print and therefore unobtainable except second-hand.

* * * *

RESTRICTIONS ON IMPORTATION OF SEED POTATOES.—The attention of potato-growers and seedsmen is called to Government Notice No. 646 of 1909, dealing with restrictions on the importation of seed potatoes, which appears under "Agricultural Notices" at the end of this number.

* * * *

MALTING BARLEY.—The attention of farmers is called to the fact that the South African Breweries, Ltd., is desirous of obtaining locally grown malting barley to avoid paying heavy import duties and to encourage the cultivation of this crop in South Africa.

* * * *

OPENING OF SCHOOL OF AGRICULTURE, POTCHEFSTROOM.—The buildings of the new School of Agriculture on the Government Experimental Farm, Potchefstroom, are completed, and the school will be opened on or about the 1st of August next. Applications for admission should be made to the General Manager, and should reach him not later than the 15th July, 1909. Conditions of admission will be found in Government Notice No. 670 of 1909, reprinted in the "Agricultural Notices" at the end of this number.

* * * *

INSECT PEST AND PLANT DISEASE REGULATIONS.—Attention is called to Government Notice No. 576 of 1909, providing new regulations for preventing the introduction and spread of insect pests and plant diseases into the Transvaal. These regulations replace Government Notices Nos. 180 and 808 of 1907, which are withdrawn. Copies of the regulations will be published as Farmers' Bulletin No. 70, which can be had free of charge on application to the Government Printer, P.O. Box 373, Pretoria.

Agricultural Notices.

Veterinary Division.

ARRANGEMENTS FOR FORWARDING PATHOLOGICAL SPECIMENS.

It is hereby notified for general information that special arrangements have been made with the Central South African Railways for forwarding pathological specimens for examination in the Veterinary Bacteriological Laboratory, and all such specimens can be sent carriage forward, if addressed to the Government Veterinary Bacteriologist, Wonderboom Station (for Laboratory Siding), and distinctly labelled "Scientific Specimens for Examination." The Government Veterinary Bacteriologist is at all times glad to make examinations and to report on pathological specimens, but farmers and others sending such are earnestly requested to write full particulars of the animal from which the specimen has been taken and to post such in time to be delivered before the arrival of the specimen, or, in case of urgency, to telegraph. The importance of doing this is urged, since occasionally, when not previously advised, specimens have arrived in too decomposed a condition for examination.

F. B. SMITH,
Director of Agriculture.

* * * *

SPONSZIEKTE OR QUARTER EVIL.

Vaccine for the prevention of this disease can be obtained on application being made through the Government Veterinary Surgeons, who will also be able to inform applicants where the necessary instruments can be purchased.

This Vaccine is only put up in tubes containing ten doses, the charge for which is 2s. 6d. per tube (sufficient vaccine for the inoculation of ten animals).

* * * *

PORTS FOR ENTRY OF STOCK.

The following are the ports for entry of stock into this Colony from the neighbouring territories:—

	Days on which open for the examination of Stock.
Vereeniging	Daily.
Volksrust	"
Villiers Drift	"
Christiana	"
Roberts Drift	Thursdays, Fridays, and Saturdays.
Schoemans Drift	Mondays and Thursdays.
Buhrmans Drift	Saturdays.
Fourteen Streams	Wednesdays.
Coal Mine Drift	Thursdays.
Mosymiani	Saturdays.
De Langes Drift	Tuesdays.
Commando Drift	Alternate Wednesdays.
Komati Poort, through which stock not provided for under Clause 5, Government Notice No. 834 of 1903, will only be allowed to proceed by rail, to be examined at Machadodorp	By special arrangement with the P.V.S.

Division of Botany.

INJURIOUS WEEDS.

Owing to the fact that of late several newly-introduced and injurious weeds have made their appearance in the Transvaal, farmers are earnestly requested to take careful notice of any new plants which have appeared on their farms and which seem to have a tendency to spread. When such are discovered, specimens of the plant, bearing flowers and, if possible, seed should be forwarded to the Government Botanist by whom they will be examined and reported upon. They should be forwarded in the same way as specimens of poisonous plants.

PLANTS POISONOUS TO STOCK.

The Division of Botany is co-operating with the Division of Veterinary Bacteriology in an investigation of the poisonous plants of the country.

Farmers who lose stock through poisoning are asked to send specimens of suspected weeds for identification and further study.

Specimens may be sent by letter post, free of charge, if addressed: "The Government Botanist, Department of Agriculture, P.O. Box 434, Pretoria." Envelopes should be clearly marked O.H.M.S.

* * * *

SPINELESS PRICKLY PEAR CUTTINGS.

Cuttings of Burbank's varieties and of the Algerian varieties bred by Professor Trabut, of Algiers, are being propagated and will probably be available for distribution during the spring. The material is scarce and costly, and only a limited number of cuttings is available for distribution. Applications for the same will be received by the Government Botanist, Pretoria, and will be filled in strict rotation, as soon as practicable; but none will be issued before 1st September, and possibly not until three or four weeks later.

* * * *

BURWEED.

The Department is taking vigorous action for the eradication of Burweed (*Xanthium spinosum*) and Mexican Poppy or "Scotch Thistle" (*Argemone mexicana*). Farmers who have complaints to make about Burweed on public roads or outspans, Crown lands, or native stads or locations should write to the Government Botanist, Department of Agriculture, P.O. Box 434, Pretoria.

* * * *

COCKLE-BUR (*Xanthium strumarium*).

On account of the dangerous character of this weed to wool and mohair growers, farmers on the Aapies, Pienaars, and Crocodile Rivers are advised to keep a sharp look-out for its appearance, especially on the banks of the rivers, and to root out the plants before they scatter seed. Any farmer who is in doubt as to the identity of Cockle-Bur can send specimens to the Government Botanist for identification. An illustrated bulletin (Farmers' Bulletin No. 54) giving an illustrated description of this weed, can be had on application to the Government Printer.

Division of Forestry.

SALE OF HEDGING FROM IRENE NURSERY.

It is hereby notified for general information that the sale of Hedge Plants from Irene Government Nursery has been discontinued. Forest trees will be disposed of as formerly

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The price list of seeds and trees supplied by this Division can be obtained free of charge on application to the Conservator of Forests or the Government Printer, Pretoria.

* * * *

Farmers' Bulletin No. 8, "The Propagation of Trees from Seed," can be obtained, free of charge, on application to the Government Printer.

Chemistry Division.

INSTRUCTIONS FOR THE SAMPLING OF SOILS.

There are many ways of taking samples of soil. The following, perhaps, will be found most convenient in this country:—

(1) Having selected a representative spot, the vegetation upon it is removed, and a hole is dug with a sharp spade to a depth of about 15 inches. One side of the hole is then trimmed with the spade so as to be smooth and vertical, the hole being cleaned out. A slice of uniform thickness, about 3 or 4 inches, is then removed by the spade down to the depth of one foot. This slice is placed on a clean board or sack and mixed with similar slices, obtained in the same way from other parts of the field. Finally, all the samples are thoroughly mixed together with a trowel or the spade, the sticks, large stones, and roots removed, and a portion of 6 or 7 lbs. placed, with a label giving details, in a clean bag or box and sent for analysis.

(2) Another, better but more laborious, method is to have wooden boxes, 6 inches square and 12 inches deep, to hold the samples. A large hole is dug with a spade at the selected spot, and a square upright block of soil is left in its centre. This is carefully

trimmed with the spade until a box will just fit over it. The upper surface of the block of soil is freed from vegetation, the box inverted over it, and forced down. The spade is next slipped under, and the box with its contents removed, a label giving particulars of the soil put in, and the lid screwed on. In this way a sample of the soil (and often the sub-soil *in situ*) is obtained which can be examined in the laboratory.

WHAT TO DO WITH THE SAMPLES.

In all cases full details as to the exact locality, date of collection, depth, crops borne, previous manurial treatment, and other circumstances connected with the soil should be enclosed with the sample. These should be written in pencil, as ink is apt to become damp and run.

Samples should be sent by passenger rail, addressed to the Chief Chemist, the Agricultural Chemical Laboratories, Pretorius Street, Pretoria, and advice of their despatch, together with details of the samples, should be sent by post to the same address.

SCHEDULE OF CHARGES FOR ANALYSIS MADE IN THE AGRICULTURAL LABORATORIES.

	£	s.	d.
1. Estimation of one constituent in a manure or feeding stuff	0	7	6
2. Estimation of two or three constituents in a manure or feeding stuff..	0	15	0
3. Complete analysis and valuation of a manure or feeding stuff ..	1	0	0
4. Analysis of water—drainage or irrigation	1	5	0
5. Partial analysis of a soil to determine fertility and manurial needs ..	2	0	0
6. Complete analysis of a soil	3	0	0
7. Analysis of milk, cream, butter, or cheese..	0	10	0
8. Milk—determination of fat and total solids	0	5	0
9. Milk—determination of fat only	0	2	6
10. Butter—determination of water and fat	0	5	0
11. Analysis of a vegetable product—hay, ensilage, roots, etc.	1	0	0

At present no charge will be made to bona-fide farmers. The charges in the above schedule refer to products sent by manure merchants, milk dealers, or others interested in trade. Samples will only be accepted if assurance can be given that they are properly taken and truly representative of the bulk. The right of publishing the results of any analysis is reserved by the Department. Should the examination of any product furnish results which are deemed of sufficient general interest, the charges may be remitted.

Samples of any product likely to be of agricultural importance will gladly be received.

Division of Entomology.

SUPPLIES.

For the benefit of farmers in outlying districts it has been considered advisable to stock the following chemicals for the purpose of exterminating various insect pests. It must, however, be remembered that remittances must in all cases accompany the orders for such supplies, and it must be distinctly stated in writing for what purpose such chemicals are required in order to comply with the Poison Regulations.

Arsenate of lead, 1s. per lb., in quantities of not less than 5 lbs.
Arsenite of soda, at 6d. per lb., in quantities of not less than 10 lbs.
Arsenic, at 6d. per lb., in quantities of not less than 10 lbs.
Carbon bisulphide, at 10s. per gallon, in one-gallon drums.
Cyanide of potassium, at 1s. per lb., in quantities of not less than 5 lbs.

Division of Horticulture.

SCIONS FOR BUDDING AND GRAFTING.

Cuttings of all kinds of fruit trees may be purchased from the Horticultural Division. Orders should be sent to the Government Horticulturist, Pretoria, who will forward them to the nearest experimental station for despatch.

The price of cuttings is 1d. per foot, and from six to ten buds may be taken from each foot length. Purchasers should allow two buds for each scion to be used for grafting purposes. Cash should accompany order in all cases, including sufficient to cover postage.

Tobacco Division.

NOTICE TO TOBACCO PLANTERS.

It is hereby notified for the information of tobacco planters that the Tobacco Division, Transvaal Department of Agriculture, is prepared to carry out the sorting, treatment, and baling of tobaccos in their tobacco rooms recently fixed up at their premises, 434 Market Street, Pretoria.

Only lots of from 1,000 to 5,000 lbs. each will be accepted. The planter must bear the cost of carriage to Pretoria, and, in addition, for the handling a small rate per lb. will be charged by the Division to defray working expenses.

For further information. write to—

W. H. Scherffius,
Chief of Tobacco Division,
P.O. Box 434, Pretoria.

Experimental Farm, Potchefstroom.

SEEDS FOR DISPOSAL.

Potatoes.

First crop from imported seed; medium and "seed" size mixed

Price.—This will be determined by the market rates ruling at the time of delivery, and can be obtained on application.

Varieties.—Early: May Queen, Epicure, and Early Rose: medium: British Queen, Flourball, and Factor; late: Scottish Triumph, Up-to-date, Langworthy, African Red, Five Towers, Charles Fidler, Duchess of Cornwall.

"Early" and "Medium" varieties will be issued from the middle to the end of August, and "Late" varieties in September and October.

Artichokes (Jerusalem).

Price.—10s. per 100 lbs. f.o.r. Potchefstroom.

Maize (Mealies).

Price. 20s per 100 lbs. f.o.r. Pochefstroom.

Colour and Character.	Variety.	Maturity.
White (dent) ...	Hickory Horsetooth ...	Late.
Do do.	Hickory King	Medium late.
Yellow (dent) ...	Golden King	Late.
Do. do. ...	Yellow Hogan	Do.
White (dent) ...	Iowa Silver Mine	Medium.
Yellow (Flint) ...	Yellow Cango	Do.
Do. do. .	New England (8-row) .	Medium early.
Yellow (dent) ...	Eureka	Do.
Do. do. ...	Star Leaming	Do.
Do. do. ...	Bristol 100-day	Do.
White (dent) ...	Champion White Pearl ...	Do.
White (flint) ...	White Cango	Do.
Yellow (dent) ...	Chester County Mammoth...	Early.
Yellow (flint) ...	Australian Ninety-day ...	Do
White (flint) ...	White Botman	Do.

This seed is shelled from carefully selected, butted, and tipped ears true to the type and character of each variety. The greatest care is exercised to ensure uniformity in the seed supplied. Some varieties are, however, somewhat "unstable" in their characteristics, and in some cases cross-fertilization may have escaped detection. These deficiencies are reduced to a minimum as far as care in the selection of the seed will permit.

Medium and late varieties are recommended for districts with a long growing period; the medium-early and early varieties are the most suitable for districts with shorter growing periods.

Applicants who have no particular choice in regard to varieties are requested to state in their application whether they prefer white or yellow varieties, when the seed will be sown, and when the first frost generally occurs on their farms. The undersigned will then select those varieties which are likely to prove the most suitable.

Manna and Millet.—*Price*—6d. per lb. f.o.r. Potchefstroom.

Note.—If issued in consignments of 100 lbs. or over, 5d. per lb.

Varieties.—"Boer" manna and "Golden Millet."

TEFF.

Price—8d. per lb. f.o.r. Potchefstroom.

Note.—If issued in consignments of 50 lbs. or over, 6d. per lb.

BROOM CORN.

Price—3d. per lb. f.o.r. Potchefstroom.

LINSEED.

Price—3d. per lb. f.o.r. Potchefstroom. (Offered in small lots for trial purposes.)

Applications for these seeds should be made on or before 12th August. No orders will be "booked" until that date, but applications may then be closed and the available supply distributed pro rata among the different applicants. In that case, only orders which are then definitely placed will be considered; an enquiry which is still the subject of correspondence will not be considered a definite order.

Orders must be accompanied by remittance. Cheques and money orders should be drawn in favour of General Manager, Experimental Farm, Potchefstroom, from whom any further particulars can be obtained. Postal orders should not be endorsed. If "seeds" are to be sent on the c.o.d. system, this authority must be given by applicant.

ALEX. HOLM,
General Manager.

Poultry Division.

STOCK BIRDS FOR SALE.

A large number of the following breeds are for disposal:—
Anconas, pullets, 10s. 6d. to 12s. 6d.; cockerels, 7s. 6d. to 10s. each
Brown Leghorns, cockerels, 10s. to 12s. 6d. each.
Black Leghorns, cockerels, 10s. to 12s. 6d. each.
White Leghorns, cockerels, 10s. to 12s. 6d. each.
Minorcas, cockerels, 10s. to 12s. 6d. each.
Buff Orpingtons, cockerels, 7s. 6d. to 10s. each.
White Wyandottes, cockerels, 10s. 6d. to 12s. 6d. each.
Pekin Ducks and Drakes, 10s. each.
Turkeys, American Bronze, 20s. each.

All prices f.o.r. Potchefstroom.

Settings of all breeds kept at 11s. per setting of 12 eggs. Unfertiles will be replaced if returned.

For further particulars and information apply—

GOVERNMENT POULTRY EXPERT,
Experimental Farm, Potchefstroom.

Editorial Division.

AVAILABLE PUBLICATIONS.

The following publications can be had, free of charge, on application to the Government Printer, Box 373, Pretoria:—

Transvaal Agricultural Journal, No. 3. Vol. I (Published quarterly.)
" " " No. 13, Vol. IV " "
" " " No. 14, Vol. IV " "
" " " No. 15, Vol. IV " "
" " " No. 21, Vol. VI " "
" " " No. 22, Vol. VI " "
" " " No. 24, Vol. VI " "
" " " No. 26, Vol. VII " "
" " " No. 27, Vol. VII " "

Division of Botany:—
Leaflet No. 1.—"Plants Poisonous to Stock."
Bulletin No. 2.—"The Conditions of Seed and Plant Distribution," 1907-08.
Circular No. 1.—"Poisonous Plants."

Division of Entomology:—
Leaflet No. 1.—"Cut Worms."
" No. 7.—"Sprays for Locust Destruction."

Division of Forestry:—
"Price List of Seeds and Trees."

Division of Horticulture :—

Bulletin No. 1.—" Some Information about Fruit Trees."
Leaflet No. 3.—" A Fruit Report."
„ No. 4.—" Diseases of Orange Trees."

Division of Veterinary Science :—

Leaflet No. 3.—" Rhodesian Tick Fever."
„ No. 6.—" Wire Worms."

Division of Publications :—

Bulletin No. 2.—" Some Diseases of the Horse."

Farmers' Bulletins :—

Farmers' Bulletin No. 1.—" Maize Foods for the Home."
„ „ No. 8.—" Propagation of Trees from Seed."
„ „ No. 10.—" How to Produce Bright Tobaccos."
„ „ No. 15.—" The Pea Nut."
„ „ No. 16.—" Meaning and Value of Analysis of Soils."
„ „ No. 17.—" Brands Directory," 1908.
„ „ No. 18.—" Judging of Butter and Cheese."
„ „ No. 19.—" The First Transvaal Co-operative Congress."
„ „ No. 20.—" The Co-operative Bacon Industry in Denmark, with a few Notes on the Transvaal."
„ „ No. 21.—" A Butter Dairy."
„ „ No. 22.—" Campbell System of Dry Land Farming."
„ „ No. 23.—" Citrus Fruit Rot."
„ „ No. 24.—" Potato Rot."
„ „ No. 25.—" New York Apple Tree Canker."
„ „ No. 26.—" Inoculation of Sheep against Blue Tongue."
„ „ No. 27.—" Tobacco Transplanting and Further Treatment in the Field."
„ „ No. 28.—" Tobacco Breeding and Selection."
„ „ No. 29.—" A Small Cheese Dairy."
„ „ No. 31.—" The Making of Full-cream Gouda Cheese on a Dutch Farm."
„ „ No. 32.—" Breakfast Cheese."
„ „ No. 33.—" The Adams Agricultural Act."
„ „ No. 34.—" The Pasteurization of Small Quantities of Milk and Cream in Bottles."
„ „ No. 35.—" Rennet Making."
„ „ No. 36.—" Butter-making."
„ „ No. 37.—" Sweet Milk Cheese-making."
„ „ No. 38.—" Rules for Butter-making."
„ „ No. 40.—" Agricultural Education in America."
„ „ No. 41.—" The Making of Edam Cheese."
„ „ No. 42.—" The Principle of the Milk Refrigerator."
„ „ No. 43.—" The Making and Storing of Ice."
„ „ No. 44.—" Charcoal Making."
„ „ No. 45.—" The Meaning and Scope of Household Science."
„ „ No. 46.—" Prevention of Bloat from Pasturing Lucerne."
„ „ No. 47.—" Ramie Cultivation."
„ „ No. 48.—" Cotton Cultivation."
„ „ No. 49.—" The Downy Mildew of the Grape."
„ „ No. 50.—" The Powdery Mildew of the Grape."
„ „ No. 51.—" Simple Medicines for the Farm."
„ „ No. 52.—" Conservation of Soil Moisture."
„ „ No. 53.—" The Food of Plants."
„ „ No. 55.—" Maize Studies."
„ „ No. 56.—" Maize Smut or Brand."
„ „ No. 57.—" Peach Freckle or Black Spot."
„ „ No. 58.—" The Root Louse of the Grape Vines."
„ „ No. 59.—" The Construction of Modern Silos."
„ „ No. 60.—" Notes on the Termites in the Transvaal."
„ „ No. 61.—" The Fowl Tick."
„ „ No. 62.—" Silk Worm Culture."
„ „ No. 63.—" Diseases, Ticks, and their Eradication."
„ „ No. 64.—" Varieties and Breeds of Maize suitable for Cultivation in the Transvaal."
„ „ No. 65.—" Black Scab or Warty Disease of the Potato."
„ „ No. 68.—" Germs and Milk."
„ „ No. 69.—" Kaffir Gift-boom."

Miscellaneous:—

Annual Report of the Director of Agriculture for the year 1903-04.
" " " " " 1904-05.
" " " " " 1907-08.

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JOURNAL DUPLICATES.

Any readers who possess and can spare duplicates of the *Agricultural Journal* would confer a great favour by returning them to the Department of Agriculture, as back numbers are now out of print, and applications are constantly being made by persons desirous of completing their sets.

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APPLICATIONS FOR THE *JOURNAL* AND NON-DELIVERY.

The Transvaal Agricultural Journal is issued free to residents in the Transvaal only.

Persons residing in the other South African Colonies or Oversea may become subscribers by paying an annual subscription of 7s., post free, starting from July in each year; 2s. extra is required for postage oversea.

Subscriptions are payable strictly in advance, and should be made by bank draft, money order, bank notes, or coin. Cheques cannot be accepted in payment, unless initialled by the Bank authorities.

All correspondence must be addressed and payments made to the Government Printer, Box 373, Pretoria.

Complaints as to non-delivery of the *Journal*, should be addressed to the Government Printer, P.O. Box 373, Pretoria, and *not to the Editor of the Journal*. It is particularly requested that changes of address should also be promptly notified to the Government Printer, in order to ensure prompt delivery to addressees and to avoid unnecessary correspondence.

Division of Brands and Fencing.

BRANDS.

All owners of great stock are strongly recommended to brand their stock. A registered brand is prima facie proof of ownership, and the recovery of lost or stolen stock which is branded is facilitated.

The branding of cattle is compulsory in the following districts:—

Zoutpansberg.	Lydenburg.
Waterberg.	Carolina.
Pretoria.	Barberton.
Middelburg.	Piet Retief.
Rustenburg.	Marico.

Application should be made to the Resident Magistrate of the District in which the stock are running. The registration fee is 5s., but no fee is charged in the above-mentioned districts.

Brands are made in five sizes, viz., 1½ ins. by ½ in. to 3½ ins. The usual size is 2½ ins. for cattle and 2 ins. for horses, but any brands containing characters such as B, P, R, or 8 should not be less than 2½ ins. in height.

Nose brands or horn brands, ½ in. high, of the same characters as the brands for great stock are supplied at a cost of 9s. Registration is not necessary, as the characters correspond with the registered brand for great stock.

The Directory for 1908, containing a full list of registered brands, together with names and addresses of owners, can now be obtained on application to the Government Printer or the Resident Magistrates, and a copy may also be seen at any post office in the Transvaal.

FENCING.

Material is issued to *owners* of farms beneficially occupied by a white person, for erection on the boundary lines of such farms, at cost price. The cost is repayable in twenty half-yearly instalments, the first falling due two years after the issue of the material. Interest at the rate of 3½ per cent. is payable from the date the loan is sanctioned by the Land Bank.

Application forms and price lists may be obtained from the Resident Magistrates or Field Cornets, and all applications should be submitted through them in order that they may append a certificate as to the beneficial occupation.

The Government specification is as follows:—

Straining posts nearer but not farther than 500 yards apart.

Iron standards not farther than 20 yards apart.

Droppers not less than 4 between standards or between standard and strainer, as the case may be.

Material can also be obtained at cost price for interior fencing, that is to say, for the enclosure of paddocks, camps, gardens, lands, etc.

LIST OF AGRICULTURAL SOCIETIES.

Barberton	**J. S. Dyce, Box 5, Barberton.**
Belfast	**I. F. Vermooten, Box 18, Belfast.**
Bethal	Bergh and Croeser, Box 3, Bethal.
Carolina	John Little, jun., Box 25, Carolina.
Ermelo	S. P. Bekker, Box 72, Ermelo.
Heidelberg	W. Harvey, Box 36, Heidelberg.
Klerksdorp	H. Bramley, Box 56, Klerksdorp.
Lydenburg	N. Lombard and M. de Souza, Box 77, Lydenburg.
Marico	S. J. van der Spuy, Box 83, Zeerust.
Middelburg	J. W. Henwood, Box 229, Middelburg.
Potchefstroom	Joubert Reitz, Box 152, Potchefstroom.
Pretoria	M. Lochhead, Box 134, Pretoria.
Standerton	J. J. Bosman, Box 26, Standerton.
Wakkerstroom	G. Maasdorp, Box 87, Volksrust.
Waterberg	J. von Backstrom, Box 7, Nylstroom.
Witwatersrand	W. H. Poultney, Box 4344, Johannesburg.
Wolmaransstad	W. W. de Greef, Box 10, Wolmaransstad.
Zoutpansberg	J. W. Johnson, Box 32, Pietersburg.

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LIST OF FARMERS' ASSOCIATIONS.

Aapjes River Ward	F. N. Carlisle, Pyramid Station, Pretoria.
Barberton	W. A. Gregory, Box 52, Barberton.
Crocodile River	E. G. D. Paggenpoel, P.O. Rietfontein West.
Eastern Transvaal	J. Campbell, Box 76, Springs.
Groot Spelonken	J. W. Walton, Private Bag, Middagzon, via Pietersburg.
Leeuwdoorns	W. H. Pilkington, Baviaans Poort, Leeuwdoorns.
Low Country	A. W. Gale, Middelrand, P.O. Devils Kloof, Zoutpansberg.
Maquassi	E. J. Brown, Maquassi Station.
New Agatha	Henry W. Molyneux, P.O. New Agatha, Zoutpansberg.
Platrand	A. H. Barron, Platrand Station.
Piet Retief	K. P. van Dijk, Box 18, Piet Retief.
Potgietersrust	H. J. Strobel, Box 33, Potgietersrust.
Pretoria Dairy	J. W. Shackell, Box 479, Pretoria.
Pretoria Poultry Club	Matt. Lochhead, Box 1129, Pretoria.
Southern Waterberg	J. A. Manson, Illawarra, P.O. Settlers.
Transvaal	E. W. Hunt, Box 3785, Johannesburg.
Transvaal Settlers	Secretary, Kroomdraai Station.
Transvaal Stock Breeders	F. T. Nicholson, Box 134, Pretoria.
Transvaal Land Owners	H. A. Baily, Box 1281, Johannesburg.
Transvaal Con. Land Co.	C. A. Madge, Box 4303, Johannesburg.
Trichardts	Thos. O. Laing, P.O. Trichardts, via Germiston.
Witwatersrand	H. J. A. Wentworth, P.O. Craighall, near Johannesburg.
Witwatersrand Dairy	**Alex. Sloan, Box 5908, Johannesburg.**
White River	**Edmond M. Dwyer, P.O. White River, via Nelspruit.**
Wolmaransstad	**Secretary, Wolmaransstad.**

* * * *

OTHER SOCIETIES.

South African Bee Keepers' Association	Hon. Secretary and Treasurer, "C.S.A.R. Headquarters, Johannesburg"; Senior Bee Expert, F. Sworder.
Magaliesberg Fruit Growers' Association	J. C. P. Maynard, Hon. Sec., P.O. Wolhuterskop, via Pretoria.

* * * *

OTHER COLONIES.

Agricultural Union of Cape Colony, D. M. Brown, Box 187, Port Elizabeth.
Bloemfontein and O.R.C. Agricultural Society, J. Fraser, Box 250, Bloemfontein.
Cape Central Farmers' Association, H. C. Hall, Bedford, Cape Colony.
Cape Stud Breeders' Association, J. Pike, Box 703, Capetown.
Natal Agricultural Union, D. M. Eadie, Timber Street, Pietermaritzburg.
Orange River Colony Central Farmers' Association, W. B. Fowler, Secretary, Hill's Buildings, Maitland Street, Bloemfontein.
Orange River Colony Stockbreeders' Association, Secretary, Bloemfontein.

Rhodesian Agricultural Union, Secretary, Box 135, Salisbury, Rhodesia.
South African Co-operative Union, A. C. Lyell, Box 574, Bloemfontein, O.R.C.
Upper Klip River Farmers' Association, Secretary, Vrede District, O.R.C.

In view of the fact that several errors have been detected in the List of Farmers Associations and Agricultural Societies in the Transvaal, we propose to publish a revised list, and shall be glad if all secretaries of associations and societies which have been omitted will kindly communicate with the Editor.

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LIST OF OFFICIALS.

The following is a list of the officials of the Transvaal Department of Agriculture, to whom enquiries respecting matters connected with agriculture may be addressed:—

The Right Hon. the Minister of Agriculture	General Louis Botha.
Director of Agriculture	F. B. Smith.
Government Veterinary Bacteriologist	Dr. A. Theiler.
Principal Veterinary Surgeon	C. E. Gray.
Acting Chief Chemist	R. D. Watt.
Agrostologist and Botanist	J. Burtt-Davy.
Plant Pathologist	I. B. Pole Evans.
Conservator of Forests	C. E. Legat.
Acting Entomologist	D. Gunn.
Horticulturist	R. A. Davis.
Chief of Tobacco Division	W. H. Scherffius.
Government Tobacco Expert	J. van Leenhoff.
Superintendent of Co-operation	B. Stilling-Andersen.
Superintendent of Dairying	Robert Pape.
Agricultural Statistician	G. F. Joubert.
Editor, *Agricultural Journal*, and Dry-Land Agronomist	William Macdonald.
Poultry Expert, Government Experimental Farm, Potchefstroom	R. Bourlay.
General Manager, Government Experimental Farm, Potchefstroom	Alexander Holm.
General Manager, Government Stud Farm, Standerton	A. McNae.
General Manager, Government Stud Sheep Farm, Ermelo	E. P. Jacobsz.
Flock-master and Wool Expert	———
Acting Manager, Government Experimental Farm, Tzaneen	Walter H. Charter.
Registrar of Brands and Controller of Fencing	J. J. Pienaar.
Government Inspector of Produce for Export	C. H. Keet.
Chief Clerk	B. Enslin.
Accountant	A. J. Firth.
Translator	Otto Menzel.
Librarian	J. C. Goldman.

* * * *

ADDRESS.

Correspondents are earnestly requested to give their full name and correct postal address when forwarding any communication to the Department. It sometimes happens that readers send their farm address only, and fail to give the Post Office address, consequently it is impossible to reply to their queries or send publications. This refers more especially to farmers applying for cattle permits, as in many cases letters forwarded by the Veterinary Division are returned by the Postal Authorities to the effect "Not delivered, Address insufficient." The Department should also be immediately notified of any change of address.

* * * *

SOUTH AFRICAN STUD BOOK.

A record of all classes of stock, the object being to encourage the breeding of thoroughbred stock and to maintain the purity of breeds, thus enhancing their value to the individual owner and to the country generally.

Application for membership and entries of stock should be addressed to—

For Cape Colony—A. A. Persse, P.O. Box 703, Capetown.
For Transvaal—F. T. Nicholson, P.O. Box 134, Pretoria.
For Orange River Colony—E. J. MacMillan, Government Buildings, Bloemfontein.

The South African Stud Book, Volume I, is obtainable from T. Maskew Miller, Adderley Street, Capetown. Price, 10s. 6d.

A. A. PERSSE, *Secretary*,
South African Stud Book Association.

Investment Board.

CONDITIONS OF BONDS AT THE TRANSVAAL LAND AND AGRICULTURAL BANK.

1. That the mortgagor will pay the principal sum mentioned in the mortgage with interest thereon in accordance with the provisions of the Land and Agricultural Bank Act, 1907, as amended by the Land and Agricultural Bank Amendment Act, 1903, and at the due dates thereof.

2. That the mortgagor will from time to time so long as money remains owing on this security, well and substantially repair and keep in good and substantial repair and condition all buildings or other improvements erected and made upon the said land, and the Bank may at all times be at liberty by itself, its agents, or servants to enter upon the said land to view and inspect the said buildings and improvements.

3. That if the mortgagor fails or neglects to repair the said buildings and improvements or to keep them in good and substantial repair and condition as aforesaid, then and in any such case and as often as the same shall happen it shall be lawful for but not obligatory upon the Bank, at the cost and expense in all things of the mortgagor, to repair the said buildings and improvements and keep them in good and substantial repair and condition.

4. That all moneys expended by the Bank in and about in repairing or keeping in repair any of the said buildings and improvements as aforesaid or in attempting to exercise or enforce any power, right, or remedy herein contained or implied in favour of the Bank shall be payable to the Bank by the mortgagor on demand, and until paid shall be charged on the said land, together with the interest thereon at the rate of not more than six per centum per annum computed from the date or dates of such moneys being expended.

5. Insurance shall be effected as may be prescribed by regulation or instruction of the Board. Every policy of insurance so effected shall be ceded to the Bank as collateral security.

6. That the power of sale and incidental powers in that behalf conferred upon the Bank under section *thirty-three* of the Land and Agricultural Bank Act, 1907, amended as aforesaid, shall be implied herein and that they may be exercised without any notice or demand whatsoever if and whenever the mortgagor makes default for three months in the full and punctual payment of any instalment of interest or principal in accordance with the respective covenants for the payment thereof herein contained or if and whenever the mortgagor makes default in the faithful observance and performance of any other covenant or condition on his part herein contained or implied.

7. That if and whenever the mortgagor makes any such default as in the last preceding covenant mentioned it shall be lawful for the Bank to call up and compel payment of all principal, interest, and other moneys for the time being owing under this security, notwithstanding that the time or times hereinbefore appointed for the payment thereof respectively may not have arrived.

8. That the mortgagor will at all times cultivate and manage the mortgaged land in a skilful and proper manner and according to the rules of good husbandry. Failure in the performance of this condition shall entail the immediate recovery of the loan should the Bank so desire. This section shall, however, not apply to a farm mortgaged as security and used exclusively for stock farming.

9. That this mortgage is subject to all the provisions of the Land and Agricultural Bank Act, 1907, amended as aforesaid, relating to mortgages under those Acts.

TRANSVAAL LAND AND AGRICULTURAL BANK, PRETORIA.

Table of Prescribed Half-Yearly Instalments

Payable in Advance for every £100 (One Hundred Pounds) of the Loan, at Seven Pounds per centum, namely, Five Pounds per centum for interest, and the balance in reduction of the capital, such half-yearly payments beginning at first half-year.

Half-Year.	Prescribed Half-Yearly Instalments.			Apportioned thus: On Account of Interest at 5 per cent.			On Account of Principal.			Balance of Principal.		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
1st	3	10	0	2	10	0	1	0	0	99	0	0
2nd	3	10	0	2	9	8	1	0	4	97	19	8
3rd	3	10	0	2	9	0	1	1	0	96	18	8
4th	3	10	0	2	8	4	1	1	8	95	17	0
5th	3	10	0	2	8	0	1	2	0	94	15	0
6th	3	10	0	2	7	4	1	2	8	93	12	4
7th	3	10	0	2	6	8	1	3	4	92	9	0
8th	3	10	0	2	6	4	1	3	8	91	5	4
9th	3	10	0	2	5	8	1	4	4	90	1	0
10th	3	10	0	2	5	0	1	5	0	88	16	0
11th	3	10	0	2	4	4	1	5	8	87	10	4
12th	3	10	0	2	3	8	1	6	4	86	4	0
13th	3	10	0	2	3	0	1	7	0	84	17	0
14th	3	10	0	2	2	8	1	7	4	83	9	8
15th	3	10	0	2	1	8	1	8	4	82	1	4
16th	3	10	0	2	1	0	1	9	0	80	12	4
17th	3	10	0	2	0	4	1	9	8	79	2	8
18th	3	10	0	1	19	8	1	10	4	77	12	4
19th	3	10	0	1	18	8	1	11	4	76	1	0
20th	3	10	0	1	18	0	1	12	0	74	9	0
21st	3	10	0	1	17	4	1	12	8	72	16	4
22nd	3	10	0	1	16	4	1	13	8	71	2	8
23rd	3	10	0	1	15	8	1	14	4	69	8	4
24th	3	10	0	1	14	8	1	15	4	67	13	0
25th	3	10	0	1	14	0	1	16	0	65	17	0
26th	3	10	0	1	13	0	1	17	0	64	0	0
27th	3	10	0	1	12	0	1	18	0	62	2	0
28th	3	10	0	1	11	0	1	19	0	60	3	0
29th	3	10	0	1	10	0	2	0	0	58	3	0
30th	3	10	0	1	9	0	2	1	0	56	2	0
31st	3	10	0	1	8	0	2	2	0	54	0	0
32nd	3	10	0	1	7	0	2	3	0	51	17	0
33rd	3	10	0	1	6	0	2	4	0	49	13	0
34th	3	10	0	1	5	0	2	5	0	47	8	0
35th	3	10	0	1	3	8	2	6	4	45	1	8
36th	3	10	0	1	2	8	2	7	4	42	14	4
37th	3	10	0	1	1	4	2	8	8	40	5	8
38th	3	10	0	1	0	0	2	10	0	37	15	8
39th	3	10	0	0	19	0	2	11	0	35	4	8
40th	3	10	0	0	17	8	2	12	4	32	12	4
41st	3	10	0	0	16	4	2	13	8	29	18	8
42nd	3	10	0	0	15	0	2	15	0	27	3	8
43rd	3	10	0	0	13	8	2	16	4	24	7	4
44th	3	10	0	0	12	0	2	18	0	21	9	4
45th	3	10	0	0	10	8	2	19	4	18	10	0
46th	3	10	0	0	9	4	3	0	8	15	9	4
47th	3	10	0	0	7	8	3	2	4	12	7	0
48th	3	10	0	0	6	0	3	4	0	9	3	0
49th	3	10	0	0	4	8	3	5	4	5	17	8
50th	6	0	8	0	3	0	5	17	8	—		

LIST OF ADDRESSES OF FIELD CORNETS.

Piet Retief.

Piet Retief	Jan Christoffel Greyling Kemp, P.O. Box 10, Piet Retief.
Assegaai River	Heinrich Martin Friedrich Meyer, P.O. Bergen.

Wakkerstroom.

Wakkerstroom	Izaak Johannes Greyling, Hangkloof, P.O. Wachteenbeetje, Wakkerstroom.
Amersfoort	Gabriel Michael Carel Swart, Vaalbank, Amersfoort.
Volksrust	Christian Burger Pringle, P.O. Volksrust.

Standerton.

Blesbokspruit	Hendrik Johannes Janse van Vuren, Rietvlei, P.O. Blesbokspruit.
Waterval	Johannes Joachim Alberts, Klipdrift, P.O. Val Station.
Klip River	Coenraad Jacobus Brits, Leeuwkraal, P.O. Platrand Stn.
Steenkoolspruit	Adam Gilfillan, Dorstfontein, P.O. Onverwacht, Bethal.
Bethal	Petrus Johannes Dirk Erasmus, Groenpunt, P.O. Box 63, Bethal.

Ermelo.

Ermelo	Abraham Gerhardus Kleynhans, Vleiplaats, P.O. Brakfontein.
Amsterdam	Johannes Nicholaas Hermanus Grobler, P.O. Bankkop.
Lake Chrissie	Barend Jacobus Johannes Smit, P.O. Box 56, Ermelo.

Carolina.

Carolina	Johannes Hieronimus Brink, P.O. Box 37, Carolina.
Theespruit	Willem Hendrik de Villiers, P.O. Box 21, Carolina.
Komati River	Johannes Lodewikus Grobler, Drenthe, P.O. Bonnefoi Stn.

Barberton.

Barberton	Hendrik Thomas Watkins, P.O. Barberton.
Wit River	Paul Michael Marits, Kaapsche Hoop.

Lydenburg.

Steelpoort	Jacobus Nieuwenhuize, Rietfontein, P.O. Boschfontein.
Ohrigstad	Pieter Barend Swart, Uitkomst, P.O. Rustplaats.
Crocodile	David Johannes Schoeman, P.O. Rietfontein, Lydenburg.
Steenkampsberg	Christiaan Cornelius Cloete Joubert, P.O. Dullstroom.

Middelburg.

Olifants River	Gerhardus Wilhelmus van Niekerk, Goedehoop, P.O. Vaalkrants.
Steenkoolspruit	Joachim Johannes Cornelis van Niekerk, Doornrug, P.O. Balmoral.
Mapochsgronden	Adam Johannes Willemse, P.O. Tonteldoos.
Selons River	Josias Servaas de Kock, P.O. Box 3, Middelburg.
Secocoenisland	Christian Ernst Schutte, Uitkyk No. 428, P.O. Pokwani, Middelburg District.

Zoutpansberg.

Mara (Noord)	Marthinus Johannes Petrus Biermann, Bergplaats, P.O. Mara.
Rhenosterpoort	Andries Stephanus David Erasmus, Smitsplaats, P.O. Pietersburg.
Marabastad	Christoffel Hofmeyr, P.O. Marabastad.
Olifants	Ernst Lodewikus Marais, De Diepte, P.O. Chunespoort.
Groot Spelonken	Johannes Frederik Lodewikus Janse van Rensburg, Rustfontein, P.O. Buffels.
Klein Spelonken	Pieter Willem Möller, Groblerplaats, P.O. Louis Trichardt.
Woodbush	Austin Welsh Wienand, Laatstehoop, P.O. Smitsdrift.
Low Country, Klein Letaba	Jacobus Cornelis Boltman, Korthanie, P.O. Duivelskloof.

Pretoria.

Crocodile River	Marthinus Nicholaas Riekert, Hartebeestpoort, P.O. Rietfontein West.
Witwatersrand	John Geo. Jones, P.O. Hennops River.
Bronkhorstspruit	Jacobus van der Walt, Knoppiesfontein, P.O. Bapsfontein, Kaalfontein Station.
Elands River	Pieter Lafras Uys, Rietfontein, Bronkhorstspruit Station.
Aapies River	Johannis Barend Wolmarans, Donkerhoek, P.O. Hatherley.

Rustenburg.

Hex River	Georg Heinrich Wilhelm Behrens, P.O. Bethanie.
Elands River	Roelof Jacobus Petrus van Tonder, Rietfontein, P.O. Brakkloof, Marico Station.
High Veld	Pieter Stephanus Steenekamp, P.O. Cyferbult.
Zwartruggens	Petrus Jacobus van der Walt, Witrand, P.O. Koster.

Heidelberg.

Roodekoppen	Andries Jacobus Greyling, Roodewal, P.O. Greylingstad Station.
High Veld	Willem Francois Pretorius, Rietfontein, P.O. Devon Station, via Springs.
Suikerboschrand	Johannes Stephanus Fourie, Boschfontein, P.O. Heidelberg.
Klip River	William George Devenish, Witkoppies, P.O. Meyerton.

Krugersdorp.

Krugersdorp	Nicholaas Jacobus Pretorius, jun., Hartebeesthoek, P.O. Scheerpoort, Pretoria.
Witwatersberg	Frederik Jacobus Potgieter, Nootgedacht P.O. Hekpoort.
West Rand	Christoffel Frederik Theodorus Hendrikz, Luipaardsvlei, P.O. Randfontein.

Potchefstroom.

Upper Mooi River	Stephanus Gottfried Kriegler, P.O. Frederikstad.
Gatsrand	Jacobus Francois van der Merwe, Leeuwkop P.O. Kraalkop.
Vaal River	Nicholaas Marthinus Prinsloo, Modderfontein, P.O. Lindequesdrift
Upper Schoonspruit	Daniel Johannes Ysel, Elandskuil, P.O. Ventersdorp.
Lower Schoonspruit	Pieter Jacobus Jooste, P.O. Box 5, Hartebeestfontein.

Marico.

Bushveld	Francois Johannes Diederik Furstenburg, Witpoortje, Zeerust.
Little Marico	Daniel Lourens Botha, Weltevreden, P.O. Box 97, Zeerust.
Great Marico	Lourens van Niekerk, Doornkraal, P.O. Wonderfontein.
High Veld	Willem Adriaan Lombaard, Rietspruit, P.O. Grootafdeeling.
Moloppo	Charles Pieter Marais, P.O. Ottoshoop.

Lichtenburg.

Zoutpan	Andries Petrus Visser, Leeuwpan, P.O. Barberspan.
Lower Harts River	Jan Hendrik Petrus van der Merwe, Boschpoort, P.O. Korannafontein.
Upper Harts River	Gabriel Johannes Greeff, P.O. Manana.

Bloemhof.

Schweizer Reneke	Louis Elwin Lauritz Mussmann, P.O. Schweizer Reneke.
Christiana	Paul Johannes Maré, Grootplaats, P.O. Christiana.
Bloemhof	Pieter de la Rey Swartz, Vaalfontein, P.O. Bloemhof.

Wolmaransstad.

Upper Ward	Wouter Cornelis Justinus Brink, Vlakfontien, P.O. Witfontein.
Lower Ward	Sarel Petrus du Toit, Wildebeestkantoor, P.O. Leeuwdoorns.

WATERBERG.

Koedoesrand & Zoutpan No. 497	Marthinus Phillippus van Staden, Hoornbosch, P.O. Oranjefontein.
Zwagershoek	Christoffel Bernardus Swanepoel, Post Bag Koppie Alleen, via Nylstroom.
Nylstroom	Hermanus Stephanus Lombard, Grootvlei, P.O. Box 21, Nylstroom.
Potgieters	Daniel Petrus van Rooyen, P.O. Potgietersrust.

Government Stud Farm, Standerton.

GOVERNMENT STALLIONS FOR LEASE.

SEASON 1909-10.

Applications to hire stallions for next season should be made before 31st July, 1909, on which date these applications will be considered.

As the number of stallions is limited, preference will be given to owners of the best class of mares.

TERMS

The season will commence on the 1st September.

Stallions will be leased to individuals, associations, or two or more breeders in conjunction, approved of by the Department.

The Lessee or Lessees to allow the farming public to send mares for service at a fixed fee, provided the list is not already full, the fees to be according to the following tariffs, viz. :—

Prices paid for hire of Stallion.	*Fee to be charged by Lessee not to exceed.*
£30	30s.
£35	35s.
£40	40s.
£50	50s.
£60	60s.

The charge for the hire of the majority of the stallions will range from £30 to £40, but for a few exceptionally high-class animals somewhat higher rates will be made.

Payment for hire of stallions must be made in advance.

Not more than 40 mares may be served by a stallion without written permission.

Stallions will be delivered by the Department at the nearest railway station to the place where they are to stand at stud, and expense of railage will be borne by the Department. At the termination of the season the stallion will be taken over by the Manager of the Government Stud Farm, or his representative.

Stallions will not be allowed to run with mares unless by special arrangement.

Due care must be taken that stallions shall not serve mares suffering from any contagious diseases.

The Manager of the Stud Farm or his representative to have the right to inspect the stallions leased, at any time.

In the event of a stallion dying during the period for which he has been leased, from any cause through which the Lessee is to blame, the Lessee will be liable for a sum equal to the price already paid for the hire of same.

The Lessee to be responsible for the good care and attention of the stallion and his equipment.

Should any of the foregoing rules not be complied with, the Department shall have the right to remove the stallion at once, and to take any action desirable for the recovery of damages, the Lessee to forfeit the money paid for hire.

Applications must be addressed to the General Manager, from whom any further information can be obtained.

Telegraphic address :—
"Horses," Standerton.
Postal address : —
Government Stud Farm,
Standerton.

A. McNAE,
General Manager.

F. B. Smith,
Director of Agriculture.

June, 1909.

The following is a list of the Stallions for lease :—

Name of Stallion.	*Pedigree.*	*Leasing Fee.*
Sir Reginald ... (Brown)	Hagioscope ... The Empress Maud	£50.
Toredo ... (Chestnut)	Torpedo ... Thetis	£50.
Anchovy ... (Bay)	St. Michael ... Sauce	£50.
Our Jack ... (Brown)	Sheet Anchor ... Dalliance	£30.
Cairn Ryan ... (Bay)	Enthusiast ... Finnart	£45.
D'Arcy ... (Bay)	Ayrshire ... Cosy	£50.
Florismart ... (Dark Bay)	Martagon ... Floranthe	£50.
The Orphan ... (Brown)	Dick Swiveller ... Beehive	£35.
Queen's Jubilee ... (Chestnut)	Queen's Birthday ... Queen of the Florin	£45.
Mon Roy ... (Chestnut)	Orme ... Mon Droit	£50.
Candil ... (Chestnut)	Sargento ... Vahlia	£35.
Voltaire ... (Brown)	Warpath ... Maythorn	£35.
Tarrone ... (Bay)	Redcourt ... Lottie	£30
King Fish ... (Brown)	Fly Fisher ... Little Nell	£30.
Kennythorpe ... (Brown)	Calthorpe ... Kenny	£40.
Little Dick ... (Dark Bay)	Dick Swiveller ... Magenta	£40.
Proxy ... (Bay)	Earl Douglas ... Dentelle	£40.
Radium (Hackney) ... (Black)	Vitality ... Ruby	£40.

Government Notices.

REGULATION *RE* IMPORTATION OF POTATOES.

On and after 1st September, 1909, no person shall introduce into this Colony from outside South Africa, any consignment of potatoes unless accompanied by a certificate from the consignor stating fully in what country and district of that country the potatoes were grown, and also a certificate from the Board of Agriculture of the country in which the potatoes were grown, to the effect that the disease known as warty disease or black-scab, caused by the fungus *Chrysophylctis endobiotica* Schil., has not been declared to exist in the district from which the potatoes come. Any consignments not accompanied by such certificates will be liable to be seized and destroyed by the Department of Agriculture.

WARNING TO FRUIT GROWERS.

The attention of owners and occupiers of orchards is called to the Insect Pests and Plant Diseases Regulations published under Government Notice No. 576 of 1909, and more particularly to Part III thereof which provides for the compulsory examination of all orchards in the Transvaal by a Government Inspector.

* * * *

SCHOOL OF AGRICULTURE, POTCHEFSTROOM.

It is hereby notified for general information that the School of Agriculture at the Government Experiment Farm, Potchefstroom, will be opened for the reception of a limited number of pupils on or about the 1st August next. Applications for admission should reach the General Manager of the Farm, Potchefstroom, not later than the 15th July, 1909.

The following are the conditions of admission :—

(2) Candidates to be over sixteen years of age.

(2) The fees—which are payable half-yearly in advance—to be £60 per annum (inclusive of board, washing, and medical attendance).

(3) By making application for admission candidates will be deemed to have undertaken to remain at the school for a period of two years if accepted.

(4) The instruction will, especially during the first year, be chiefly practical, and, besides stock-breeding and managing and crop husbandry, will include dairying, poultry-keeping, and horticulture. This work to be supplemented by lectures on these subjects and the sciences relating to agriculture given by the residential staff and officers of the Department.

(5) Candidates must furnish proof that they have passed the sixth standard of an elementary school, the school higher examination, the matriculation examination, or their equivalents.

(6) Candidates must furnish evidence of good moral character and of good health with their applications.

* * * *

INVESTMENT BOARD.

It is hereby notified for general information that the Investment Board is prepared to consider offers for the purchase of the undermentioned properties.

In the case of approved purchasers, two-thirds of the purchase price will be allowed to remain on bond, bearing interest at 6 per cent. per annum.

For further particulars apply to the Acting Secretary to the Investment Board, Law Courts Building, Pretoria.

LICHTENBURG.

Portion No. 9, in extent 15 morgen 135 square roods, of the remaining portion of Biesjesvallei No. 57.

MIDDELBURG.

Erf No. 697. Vacant.

MARICO.

Undivided ⅛ of Putfontein No. 326, in extent approximately 3,000 morgen.

PRETORIA.

Portion of Erven Nos. 44 and 45, No. 421 Pretorius Street, Arcadia, on which are the following buildings :-

(1) House containing six rooms, kitchen, pantry, and bathroom.

(2) Block of seven rooms and bathroom.

(3) Complex of eight rooms, kitchen, and bathroom.

(4) Two blocks, each containing two semi-detached cottages, each comprising three rooms, kitchen, pantry, and bathroom.

Erf No. 896, President Street. Vacant.

RUSTENBURG.

Portion "E," in extent 139 morgen 88 square roods, of Naauwpoort No. 214.

Undivided half of Erf No. 11 of the farm Cyferfontein No. 963, in extent 11 morgen 309 square roods, with right of free grazing over remaining portion of the farm and also on the remaining portion of Leeuwpoort No. 705.

WATERBERG.

Duikerhoek No. 728, in extent 1914 morgen 578 square roods. (About 65 miles from Nylstroom.)

Zetland No. 67, in extent about 3,000 morgen. (Twelve hours from Nylstroom on the Limpopo.)

F. W. MEADLEY,
Acting Secretary to the Investment Board.

Office of the Investment Board,
Pretoria, 8th June, 1909.

Additions to the Library.

LIST OF COMPLETE WORKS, REPORTS, AND BULLETINS, ETC.,
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Third Annual Statement Trade and Shipping of Colonies forming South African Customs Union, 1908.
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No. 1, 1909—"Agricultural Impressions of American Cotton Crop."
O.R.C.—4th Annual Report, Department of Agriculture, 1907-08.
Sudan.—Reports on the Finance, Administration, and Condition of the Sudan, 1907.
Transvaal Municipal Accounts, 1907-08.
Transvaal Finance Accounts, 1907-08, and Auditor-General's Report thereon.
Transvaal—Annual Report, Mines Department, year ended 30th June, 1908.
Transvaal—Annual Report, Department of Posts and Telegraphs, year ended 30th June, 1908.
Transvaal—Finance Accounts for Financial Year 1907-08.
Transvaal—Annual Report Government Laboratories, 1907-08.
Uganda Protectorate.—
Annual Report on the Botanical, Forestry, and Scientific Department, year ended 31st March, 1909.
Wellcome Research Laboratories at the Gordon Memorial College, Khartoum, Third Report, 1908.

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Arkansas Agricultural Experiment Station.—
Bulletin No. 102.—"The San José Scale in Arkansas."
Canebrake Agricultural Experiment Station.—
Bulletin No. 26.—"Fertilizer Tests with Cotton Cover Crops, Alfalfa."
Carolina (South) Agricultural Experiment Station.—
Bulletin No. 137.—"Hook-worm Disease of Cattle."
,, No. 139.—"Milk Fever (parturient parosis)."
,, No. 140.—"Some Conditions Influencing Cotton Production."
,, No. 141.—"Treatment of Plant Diseases and Injurious Insects in S. Carolina."
Connecticut Agricultural Experiment Station.—
Eighth Report State Entomologist, 1908.
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Bulletin No. 249.—"Four Methods of Feeding Early-hatched Pullets."
,, No. 250.—"Bovine Tuberculosis."
,, No. 252.—"Insect Pests and Plant Diseases."
,, No. 253.—"Black Rot of the Grape and its Control."
,, No. 254.—"Drainage in New York."
,, No. 255.—"Bean Anthracnose."
,, No. 256.—"Street Trees."
,, No. 257.—"Defects in American Cheddar Cheese."
,, No. 258.—"Moulting of Fowls."
Idaho Agricultural Experiment Station.—
Bulletin No. 64.—"Planting Apple Orchards in Idaho."
,, No. 65.—"Alaska Wheat Investigation."
Press Bulletin No. 15.—"Information Concerning Alaska Wheat."
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Circular No. 125.—"The Sheep Industry from the Market Standpoint."
,, No. 126.—"Food Requirements of Growing and Fattening Swine."
,, No. 127.—"Shall We Use Natural Rock Phosphate or Manufactured Acid Phosphate?"
,, No. 128.—"Proc. Confce. Animal Tuberculosis at University, Illinois, October, 1908."
,, No. 129.—"Market Classes and Grades of Sheep."
,, No. 123.—"The Status of Soil Fertility Investigations."
,, No. 124.—"Chemical Principles of Soil Fertility."

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Press Bulletin No. 172.—"Distribution of Improved Seed Wheat."
" " No. 173.—"Field Tests with Experimental Horse Serum. Hog Cholera Vaccine."
" " No. 174.—"A Troublesome Parasite of the Horse."
" " No. 171.—"Importation of Seed Wheat."
" " No. 170.—"Mixed Feed and the Kansas Feeding Stuffs Law."
" " No. 156.—"The Yellow Berry Problem in Kansas."
" " No. 157.—"Studies on Hog Cholera and Preventive Treatments."
" " No. 176.—"An Explanation of the Kansas Feeding Stuffs Law."
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" No. 43.—"Fertilizer Analyses."

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" No. 218.—"Vegetable Seed Distribution for 1909."
" No. 219.—"The First Season with the Peach Orchard."
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" No. 69.—"Experiments on the Digestibility of Prickly Pear."

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" No. 83.—"Pork Production under North Dakota conditions."

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" No. 102.—"Digestibility of Kale."

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" No. 79.—"The Relation of Steer Feeding to Farm Economics."
" No. 80.—"Home Grown Rations in Economical Production of Milk and Butter."

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" No. 109.—"Proteolytic Changes in the Ripening of Camembert Cheese."
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" No. 135.—"Officials Connected with Dairy Interests."
" No. 136.—"How to Build a Stave Silo."
" No. 137.—"The Preservation of our Native Types of Horses."
" No. 138.—"Infectious Anemia or Swamp Fever of Horses."
" No. 141. "Foot and Mouth Disease."
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" " No. 337.—"Cropping Systems for New England Dairy Farm."
" " No. 338.—"Macadam Roads."
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" " No. 343.—"Cultivation of Tobacco in Kentucky and Tennessee."
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" " No. 347.—"The Repair of Farm Equipment."
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" " " No. 5.—"Silage and Silo Construction."
" " " No. 6.—"Successful Field Experimentation."
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" " " No. 8.—"Farm Architecture."
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Forest Service Circular No. 150.—"Douglas Fir."
" " " No. 155.—"The Production and Consumption of Basket Willows in the U.S., 1906-07."
" " " No. 156.—"Report on Grazing Experiments in a Coyote-proof Pasture."
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" " " No. 159.—"The Future Use of Land in U.S."
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" " " " No. 137.—"Seeds and Plants Imported from 1st January, 1908, to 31st March, 1908."
" " " " No. 138.—"Production of Cigar Wrapper Tobacco under Shade"
" " " " No. 142.—"Seeds and Plants Imported, 1st April, 1908, to 30th June, 1908."
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" " " " No. 144. "Apple Blotch."
" " " Circular No. 16.—"A New Basis for Barley Valuation and Improvement."
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" " " " No. 19.—"The Decay of Oranges in Transit."
" " " " No. 20.—"Electrical Resistance Method for Rapid Determination of Grain Moisture."
" " " " No. 21.—"Farmers' Co-operative Demonstration Work"
" " " " No. 22.—"Farm Methods of Applying Land Plaster."
" " " " No. 23.—"Potato Diseases in San Joaquin County, California."
" " " " No. 24.—"Alfalfa in Cultivated Rows for Seed Productions in Semi-arid Regions.
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" " Agricultural Statistics, 1866-1907.
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" No. 179.—"Home-made Soluble Oils for Use against the San José Scale."
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" No. 214.—"Agricultural Credit Banks."
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Report on the Management of the Provincial and District Gardens, 1907-08.
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" " " No. 2.—"Teak Defoliator."
" " " No. 3.—"Teak Leaf Skeletoniser."
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Report for year ended 30th June, 1908.

Madras Department of Agriculture (Vol. III).—
Bulletin No. 59.—"Sunnhemp (Crotalaria Jundea)."
Pusa Agricultural Research Institute.—
Bulletin No. 13.—"Sugarcane at the Partacgarh Experimental Station."
" No. 14.—"The Milling and Baking Qualities of Indian Wheats."

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Aikman, C. M.	... Manures and the Principles of Manuring, 1902.
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Asmis, Dr. W.	... Die Regelung der Sonntagsruhe in Milchhandel im Deutschen Reich, 1908.
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Card, F. W.	... Farm Management, 1907.
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Castle, W. E., and Forbes, A.	... Heredity of Hair Length in Guinea Pigs and its Bearing on the Theory of Pure Gametes, 1906.
Cavers, F.	... Plant Biology, 1907.
Cheeseman, T. F. ...	... Manual of the New Zealand Flora, 1906.
Claassen, H.	... Beet Sugar Manufacture, 1907.
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Martiny, B.	Wörterbuch der Milchwirtschaft aller Länder, 1907.
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OBSERVATIONS OF TEMPERATURES (FROM SELF-REGISTERING THERMOMETERS IN THERMOMETER SCREENS).—MARCH, 1909.

PLACE.	For the Month. Mean Max.	Mean Min.	Mean.	HIGHEST.	LOWEST.
	degs.	degs.	degs.	degs.	degs.
Bloemhof	77·0	56·0	66·5	84·0 on 1st	49·0 on 16th
Johannesburg—					
Joubert Park ...	68·5	53·7	61·1	76·3 ,, 2nd	47·2 ,, 15th
Observatory ...	68·4	54·5	61·4	75·8 ,, 27th	49·8 ,, 17th
Komatipoort	86·3	65·3	75·8	98·0 ,, 31st	56·0 ,, 19th
Pretoria, Arcadia ...	77·5	56·0	66·8	86·8 ,, 1st	50·1 ,, 21st
Volksrust	71·8	52·1	62·0	80·7 ,, 2nd	43·5 ,, 15th
Zeerust	75·9	57·4	66·6	88·0 ,, 1st	51·6 ,, 14th

A mild and cloudy month, with a mean temperature below the normal by four degrees over the western border and by one degree over the centre of the Colony. Maximum temperatures by day have been below the average, minimum temperatures by night above the average.

RAINFALL RETURN FOR MARCH, 1909.

(Including Rainfall since 1st July last and the averages for five seasons.)

NOTE.—The rainy season is measured from 1st July in one year to the 30th June in the next.

DISTRICT.	PLACE.	Month. Mar., 1909. Ins.	Days.	Season. From 1st July, 1908. Ins.	Days.	Averages. Month. Ins.	Days.	Season. Ins.	Days.
Barberton ...	Barberton	6·24	18	44·88	119	3·41	11	25·04	77
	Komatipoort	1·79	11	28·70	67	2·66	7	22·89	56
Bethal ...	Bethal	3·10	15	35·34	101	2·87	10	26·90	80
Bloemhof ...	Bloemhof	3·50	11	30·19	80	2·98	11	19·54	64
Ermelo ...	Ermelo	4·46	14	30·68	95	3·75	13	29·06	88
Lydenburg ...	Pilgrims Rest	6·35	15	58·09	123	5·13	17	36·67	109
Marico ...	Zeerust	5·92	21	39·70	100	3·08	13	23·60	52
Middelburg ...	Middelburg	5·42	16	35·90	95	3·14	12	26·96	82
Potchefstroom	Potchefstroom	2·57	13	26·68	83	2·50	11	22·06	70
Pretoria ...	Arcadia, Pretoria ...	9·61	19	48·29	102	4·14	14	28·01	83
	Govt. Buildings, Pretoria	9·19	14	44·04	94	—	—	—	—
Rustenburg ...	Rustenburg	5·70	14	29·24	86	—	—	—	—
Wakkerstroom	Volksrust	3·60	14	41·73	107	3·49	13	31·11	88
Waterberg ...	Potgietersrust	0·99	6	23·47	60	2·11	7	24·90	60
Witwatersrand	Joubert Park, J'burg ...	5·71	15	48·69	112	5·69	15	33·38	90
	Govt. Observatory, J'burg	4·72	14	41·10	100	3·90	12	28·36	85
Zoutpansberg	Pietersburg	1·76	7	20·51	60	2·46	9	19·02	55
	Louis Trichardt	5·06	16	—	—	—	—	—	—

SUMMARY.—The rainfall during March was assisted by cloudy skies, so that the country generally remains very damp. The March rainfall was generally ample, that measured at Pretoria being a record for the month.

Over the Waterberg and the west of the Zoutpansberg very little rain fell.

The season's (9 month's) rainfall is above the average at all places, excepting over the region just mentioned.

Observations of Temperatures (from Self-registering Thermometers in Thermometer Screens).—April, 1909.

Place.	For the Month. Mean Max.	Mean Min.	Mean.	Highest.	Lowest.
	degs.	degs.	degs.	degs.	degs.
Bloemhof	75·5	50·7	63·1	81·0 on 8th	31·0 on 30th
Johannesburg—					
Joubert Park ...	68·6	48·5	58·6	74·2 „ 9th	36·5 „ 30th
Observatory ...	68·6	51·4	60·0	74·6 „ 20th	37·1 „ 30th
Komatipoort	86·8	58·7	72·8	97·0 „ 10th	40·0 „ 30th
Potgietersrust	77·6	48·5	63·0	85·0 „ 1st	40·0 „ 14th&28th
Pretoria, Arcadia ...	78·0	48·7	63·4	84·6 „ 8th	36·0 „ 30th
Volksrust	71·9	45·2	58·6	79·5 „ 21st	35·0 „ 30th
Zeerust	78·0	50·8	64·4	84·0 „ 8th	36·4 „ 30th

The past April resembled that of 1908, both months being unusually cloudless and with less than their average rainfall. Frosts, which occurred about the 12th April, 1908, were this year delayed until the 30th. Before this cold snap, temperatures had been unusually mild, so that the mean temperature of the month is five degrees above normal: this was gained nearly all by night temperatures, which at many places were 10 degrees above those of 1908.

Rainfall Return for April, 1909.

Note. The rainy season is measured from 1st July in one year to the 30th June in the next.

District.	Place.	Month April, 1909. Ins.	Days.	Season From 1st July, 1908. Ins.	Days.	Averages Month. Ins.	Days.	Season. Ins.	Days.
Barberton ...	Barberton	1·54	6	46·42	125	1·79	6	28·84	83
	Komatipoort	0·71	2	29·41	69	1·90	5	24·80	61
Bethal ...	Bethal	0·19	2	35·53	103	1·30	5	28·20	85
Bloemhof ...	Bloemhof	0·25	6	30·44	86	1·57	7	21·07	71
Carolina ...	Carolina	0·73	4	33·08	95	1·48	—	25·59	70
Ermelo ...	Ermelo	1·45	5	32·13	100	1·82	6	31·03	92
Heidelberg ...	Heidelberg	0·15	2	38·51	102	1·36	5	28·94	80
	Vereeniging	0·29	1	39·01	108	1·41	5	26·37	89
Lydenburg ...	Belfast	1·15	5	38·95	97	1·70	7	31·37	98
	Pilgrims Rest	4·06	15	62·15	138	2·46	16	39·14	125
Marico ...	Zeerust	1·06	4	40·76	104	1·74	6	25·34	79
Middelburg ...	Middelburg	0·97	4	36·87	94	1·27	5	27·64	86
Piet Retief ...	Piet Retief	2·22	7	47·83	121		...	—	—
Potchefstroom	Potchefstroom	0·81	4	27·49	87	1·78	5	23·85	75
	Klerksdorp	1·72	3	34·00	91	1·95	6	24·60	85
Pretoria ...	Govt. Buildings, Pretoria	0·08	2	44·12	87	0·84	4	26·40	74
	Arcadia	0·19	5	48·48	107	0·99	5	29·52	89
	Modderfontein	0·82	4	45·95	98	1·45	5	29·25	88
Rustenburg ...	Rustenburg	0·24	2	29·48	88	--	—	—	—
Standerton ...	Standerton	0·42	2	35·45	97	—	—	---	—
Swaziland ...	Mbabane...	1·87	8	70·20	153	3·09	9	47·70	121
Wakkerstroom	Volksrust	0·61	4	42·34	111	1·80	8	32·92	94
	Wakkerstroom	1·77	4	36·68	71	1·90	4	—	—
Waterberg ...	Nylstroom	0·80	4	31·94	79	0·92	4	24·09	69
	Potgietersrust	0·69	4	24·16	64	0·69	4	25·31	66
Witwatersrand	Krugersdorp	0·19	2	41·12	94	1·19	5	24·27	89
	Joubert Park, J'burg ...	0·33	4	49·07	117	1·23	6	34·05	94
	Govt. Observatory, J'burg	0·15	3	41·25	103	1·11	6	29·47	90
Wolmaransstad	Wolmaransstad	0·30	4	—	—	—	—	—	—
Zoutpansberg	Pietersburg	0·31	4	20·82	64	0·75	4	19·77	59

Summary.—Over the high veld the rainfall during April was fortunately very much below the average. Over the eastern border the rainfall was about normal.

The great rains of January and February cause the season's total rainfall to be much above the average generally, the exception being the north-western part of the Colony, where it falls slightly below the average.

Water is generally plentiful, but along some part of the eastern border (Sable Game Reserve) springs are stated to be lower than they have been for many years.

Observations of Temperatures (from Self-registering Thermometers in Thermometer Screens).—May, 1909.

Place.	For the Month. Mean Max.	Mean Min.	Mean.	Highest.	Lowest.
	degs.	degs.	degs.	degs.	degs.
Bloemhof	69·1	41·5	55·3	77·0 on 22nd	30·0 on 26th
Johannesburg—					
Joubert Park ...	61·9	42·9	52·4	68·3 „ 16th	36·0 „ 25th
Observatory ...	62·1	46·0	54·0	69·3 „ 16th	39·0 „ 19th
Komatipoort	81·5	54·1	67·8	92·0 „ 17th	46·0 „ 3rd
Pietersburg	73·9	42·5	58·2	80·0 „ 26th	36·0 „ 1st
Pretoria, Arcadia ...	71·7	41·0	56·4	76·8 „ 17th	31·3 „ 31st
Volksrust	63·7	39·0	51·4	72·1 „ 27th	29·7 „ 1st
Zeerust	70·6	41·4	56·0	76·5 „ 16th	31·2 „ 26th

May has been a mild month with cloudiness above the average. Temperatures were about normal.

Rainfall Return for May, 1909.

Note.—The rainy season is measured from 1st July in one year to the 30th June in the next.

District.	Place.	Month. May, 1909. Ins.	Days.	Season. From 1st July, 1908. Ins.	Days.	Averages. Month. Ins.	Days.	Season. Ins.	Days.
Barberton ...	Barberton	0·40	4	46·82	129	0·12	2	28·96	85
	Komatipoort	0·72	5	30·13	74	0·40	2	25·20	63
Bethal ...	Bethal	0·88	3	36·41	106	0·36	4	28·56	89
Bloemhof ...	Bloemhof	1·84	10	32·28	96	0·75	5	21·83	77
Carolina ...	Carolina	0·23	6	33·31	101	0·07	1	25·66	71
Ermelo ...	Ermelo	0·44	6	32·87	95	0·14	2	31·44	93
Heidelberg ...	Vereeniging	0·92	8	39·93	116	0·46	4	26·83	90
	Heidelberg	0·41	6	38·92	108	0·23	3	29·17	85
Lichtenburg ...	Lichtenburg	1·04	6	38·37	88	0·32	3	24·35	77
Lydenburg ...	Belfast	0·67	4	39·62	101	0·23	2	32·78	95
	Pilgrims Rest	1·33	9	63·48	147	0·50	7	39·64	133
Marico ...	Zeerust	0·46	4	41·22	108	0·23	2	25·58	81
Middelburg ...	Middelburg	0·61	4	37·48	98	0·29	2	27·93	89
Piet Retief ...	Piet Retief	0·63	5	48·46	126	—	—	—	—
Potchefstroom	Potchefstroom	1·45	6	28·94	93	0·53	3	24·38	79
	Klerksdorp	1·93	9	35·93	103	0·62	4	25·12	89
Pretoria ...	Arcadia, Pretoria ...	1·31	6	49·79	113	0·38	2	29·90	90
	Govt. Buildings, Pretoria	1·31	3	45·43	90	0·38	2	26·80	76
	Modderfontein	0·49	4	46·44	102	0·35	2	29·53	89
Rustenburg ...	Rustenburg	1·41	2	30·89	90	—	—	—	—
Standerton ...	Standerton	0·99	4	36·48	103	0·44	3	—	—
Swaziland ...	Mbabane	2·14	7	70·20	153	0·77	4	48·11	124
Wakkerstroom	Volksrust	1·51	10	43·85	121	0·57	4	34·89	99
	Wakkerstroom	0·99	7	37·67	78	0·46	3	—	—
Witwatersrand	Krugersdorp	0·93	5	42·05	99	0·35	3	27·94	91
	Joubert Park, J'burg ...	0·93	7	50·00	124	0·33	3	34·40	97
	Govt. Observatory, J'burg	1·08	5	42·33	108	0·34	2	29·82	93
Zoutpansberg	Pietersburg	0·20	2	21·02	66	0·06	1	19·83	61
	Leydsdorp	0·09	1	41·22	76	0·39	8	32·20	67

The May rainfall was generally much above the average, and is stated by old farmers to have provided what was called "ploughing-rains." The month was also remarkable for morning mists and heavy dews.

Pretoria and Johannesburg Market Prices.

(Produce Prices supplied by the Commercial Agency Co., Limited, Seed and Produce Merchants, No. 116 Vermeulen Street, Telephone No. 165, Box 784, Pretoria; and by Messrs. Hubert Morisse & Co., Produce Merchants and Commission Agents, Loveday and Frederick Streets, Box 63, Johannesburg. Live Stock Prices by Mr. Alfred Webb, Produce Agent to the Cape Government, 1 Parker's Building, Market Street, P.O. Box 2342, Johannesburg.)

PRETORIA.

Description.	*March*, 1909.						*April*, 1909.						*May*, 1909.					
	Lowest.			Highest.			Lowest.			Highest.			Lowest.			Highest.		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
Bran, per bag	0	8	0	0	9	0	0	8	6	0	9	0	0	8	9	0	9	9
Barley, per bag	0	14	6		—			—			—		0	13	6		—	
Butter, per lb.	0	1	0	0	1	3	0	0	9	0	1	3	0	1	0	0	1	6
Beans (dry), per bag ...		—			—			—			—		0	15	0		—	
Ducks, each	0	2	3	0	3	1	0	2	3	0	2	8	0	2	8	0	3	0
Eggs, per doz.	0	1	10	0	2	1	0	1	4	0	1	11	0	1	6	0	1	9
" (fresh) ...	0	2	11	0	3	1	0	1	9	0	3	1	0	2	0	0	2	6
Forage, 100 bundles ...	0	15	0	1	2	0	0	16	6	1	7	0	0	17	6	1	13	0
Fowls, each	0	1	1	0	2	4	0	1	3	0	2	6	0	1	9	0	2	6
Hay, per bale	0	0	4	0	1	1	0	0	4	0	0	7	0	0	7	0	1	2
Kaffir Corn, per bag ...		—		0	13	3		—		0	11	9	0	9	6	0	10	6
Green Lucerne, per doz. bundles	0	0	9	0	1	0	0	0	8	0	1	6	0	0	10	0	2	0
Manna, per 100 bundles ...	0	7	0	0	10	3	0	4	9	0	9	6	0	6	6	0	14	0
White Mealies, per bag ...	0	12	6	0	15	9	0	9	3	0	10	6	0	9	3	0	10	6
Onions, per bag	0	4	6	0	12	0	0	7	6	0	12	0	0	8	6	0	12	6
Pigs, each	1	4	0	1	8	0					—		1	1	0	2	9	0
Pumpkins, each	0	0	7	0	0	8		—			—			—			—	
Potatoes, per bag	0	14	0	0	19	0	0	13	0	1	8	0	0	14	9	1	5	0
Sweet Potatoes, per bag ...		—			—		0	4	9	0	5	3	0	5	6	0	7	0
Oats (seed), per bag ...	0	9	0	0	12	6	0	8	0		—			—			—	
Boer Meal, per bag ...		—		1	9	0		—		1	10	0	1	11	6	1	13	0
Turkeys, each	0	5	6	0	13	6	0	6	0	0	13	6	0	6	0	0	10	0
Tobacco, per roll		—			—		0	0	5½	0	0	9	0	0	4		—	
Wheat, per bag	1	3	0		—		1	7	0		—		1	4	6		—	
Firewood, per load ...	0	12	0	1	14	0	0	8	6	1	16	0	0	12	0	2	17	0
Chaff (pressed) per bale ...	0	1	3	0	1	6	0	1	4	0	1	7		—			—	
Monkey Nuts (per bag) ...		—			—		0	12	0		—			—			—	
Buckwheat		—			—			—			—		0	16	9	1	0	0

JOHANNESBURG.

Description.	*March*, 1909.						*April*, 1909.						*May*, 1909.					
	Lowest.			Highest.			Lowest.			Highest.			Lowest.			Highest.		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
Barley, per 163 lbs. ...	0	9	6	0	15	0	0	8	9	0	15	9	0	8	0	0	12	6
Bran, per 100 lbs. (Colonial)	0	7	6	0	9	0	0	8	10	0	9	3	0	8	6	0	9	0
Chaff, best, per 100 lbs. ...	0	2	9	0	3	6	0	2	9	0	4	0	0	2	9	0	4	6
Eggs, per doz. (Colonial) ...	0	1	8	0	2	3	0	1	4	0	2	0	0	1	3	0	1	9
Salt, per bag	0	4	9	0	5	6	0	4	9	0	5	6	0	4	9	0	5	6
Forage (Transvaal) ...	0	5	6	0	7	0	0	5	6	0	6	9	0	6	6	0	7	6
„ (Colonial), best, 100 lbs	0	6	3	0	7	0	0	6	6	0	6	9	0	6	9	0	7	6
„ med. and inferior „	0	1	0	0	5	9	0	1	6	0	5	6	0	3	0	0	6	0
S. Meal, best fine	1	6	3	1	8	9	1	8	6	1	9	6	1	8	6	1	13	0
Rye	0	12	0	0	13	3	0	13	9	0	15	0	0	15	9	0	17	0
Wheat	0	19	0	1	2	0	0	18	6	1	2	6	0	17	6	1	3	6
Mealies, Hickory King Whites	0	13	9	0	14	9	0	10	6	0	16	1	0	9	6	0	10	9
„ (O.R.C.), Whites ...	0	13	6	0	14	0	0	10	3	0	15	3	0	9	3	0	10	3
„ Yellow	0	11	4	0	13	7	0	9	2	0	11	3	0	9	10	0	10	9
Kaffir Corn, per 203 lbs. ...	0	9	6	0	12	0	0	9	0	0	11	1	0	8	6	0	11	3
Hay, sweet (Transvaal) ...	0	1	0	0	3	6	0	0	9	0	1	6	0	0	7	0	1	3
Lucerne, per 100 lbs. ...	0	4	0	0	6	0	0	4	6	0	6	9	0	5	0	0	7	0
Manna	0	1	6	0	4	6	0	1	6	0	4	0	0	2	9	0	4	3
Transvaal Hay	0	0	6	0	1	3	0	0	4	0	1	3	0	0	6	0	1	2
Oats, per 153 lbs.	0	6	6	0	11	6	0	5	6	0	12	6	0	5	6	0	12	6
Potatoes, best, per 153 lbs.	0	12	6	1	0	0	0	13	6	1	1	6	0	15	0	1	1	6
„ med. and inferior...	0	6	0	0	13	6	0	6	6	0	18	6	0	10	6	0	18	0
Onions, per 120 lbs. ...	0	6	0	0	12	0	0	3	6	0	15	6	0	7	6	0	12	0
Turkeys, cocks	0	5	0	0	15	0	0	3	6	0	15	6	0	3	6	0	11	6
„ hens	0	2	9	0	5	6	0	2	10	0	5	3	0	2	10	0	4	6
Fowls	0	1	0	0	3	6	0	1	0	0	3	0	0	1	3	0	3	6
Ducks	0	1	6	0	2	6	0	1	8	0	3	0	0	1	8	0	2	9
Geese	0	4	9	0	5	9	0	4	3	0	5	6	0	4	6	0	5	6
Pigeons	0	0	9	0	1	0	0	0	9	0	1	3	0	0	11	0	1	3
Butter (O.R.C.), per lb. ...	0	0	5	0	0	10	0	0	7½	0	1	4	0	0	9	0	1	4
Pumpkins, each	0	0	2	0	0	6	0	0	1	0	0	4	0	0	1	0	0	6
Beans, per 200 lbs. (sound)	0	12	6	2	0	0	0	12	0	2	6	0	0	13	6	2	0	0
Boer Goats	0	10	0	0	18	0	0	10	0	1	0	0	0	10	0	0	18	0
Donkeys	5	0	0	7	0	0	5	0	0	7	0	0	5	0	0	7	10	0
Oxen (slaughter)	8	0	0	14	0	0	8	0	0	12	0	0	8	0	0	12	10	0
„ (dressed), 100 lbs. ...	1	5	0	1	14	0	1	2	6	1	12	6	1	2	6	1	12	6
Pigs, live, per lb.	0	0	3	0	0	4	0	0	3	0	0	4	0	0	3	0	0	4
Sheep (hamels)	0	14	0	1	4	6	0	12	0	1	2	0	0	12	0	1	2	6
„ (dressed), per lb ...	0	0	4	0	0	4¾	0	0	3¾	0	0	4¼	0	0	3½	0	0	4

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